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DOCUMENTS EXPEDITING PROJECT

HEALTH INQUIRY

THE TOLL OF OUR MAJOR DISEASES THEIR CAUSES, PREVENTION, AND CONTROL

PRELIMINARY REPORT

OF THE

COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE

PURSUANT TO SECTION 136 OF THE LEGISLATIVE REORGANIZATION ACT OF 1946, PUBLIC LAW 601, 79TH CONGRESS, AND HOUSE RESOLUTION 127, 83D CONGRESS

SUBMITTED BY MR. WOLVERTON, CHAIRMAN

FEBRUARY —, 1954.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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83D CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
2d Session } { No. ——

HEALTH INQUIRY

THE TOLL OF OUR MAJOR DISEASES—THEIR CAUSES, PREVENTION, AND CONTROL

FEBRUARY —, 1954.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. WOLVERTON, from the Committee on Interstate and Foreign Commerce, submitted the following

PRELIMINARY REPORT

FOREWORD

The Committee on Interstate and Foreign Commerce is pleased to transmit to the Congress this preliminary report of the committee, summarizing important facts about health and disease today.

This committee ever has been keenly aware of its legislative responsibilities in the field of health. Further in discharge of these responsibilities, the committee last fall after the adjournment of the Congress initiated a health inquiry, the first phase of which was a study of our present-day knowledge of the causes, prevention, and control of some of the principal diseases of today.

While this inquiry is continuing at the present time, and will result in further reports to the Congress, it has seemed to the committee that the testimony concerning these major diseases has been so significant and comprehensive that it warrants being drawn together in this preliminary report so that all may have the benefit of this knowledge.

In this first phase of the inquiry relating to disease, the committee was concerned specifically with finding out just what has been accomplished, how it has been accomplished, what the problems are, what the immediate future holds, and what additional steps might be taken by way of research, or other measures, to hasten relief from these dreadful diseases, mitigate human suffering, and curtail the losses which disease inflicts on our national economy. Testimony on this subject was given to the committee last October, as a necessary background for the second phase of the inquiry which represents a study of ways and means of providing protection for the American people against the heavy burden, and all too frequent financial catastrophe, arising from the major illnesses.

The hearings from October 1 through October 12, 1953, the essentials of which are contained in this document, were conducted as a series of panel discussions. Participants were 95 distinguished physicians, scientists, and laymen. The committee's purpose in asking them to come before the committee was to advise the members on the current status of knowledge in specific fields, to document the extent of public and private efforts to find the causes of and to control disease, and to highlight the health problems and health needs of the Nation today.

The members of the committee were tremendously impressed by the caliber of the men and women who took part in these hearings. They demonstrated a keen knowledge of their fields, a splendid awareness of their public responsibilities, a total willingness to cooperate and to coordinate their efforts, and an inspiring devotion to the high purpose of better health and more productive life for all Americans. The committee is grateful for the participation and advice of this group of distinguished individuals.

The committee directed its attention during this first phase of the health inquiry to heart disease, cancer, arthritis and rheumatism, poliomyelitis, tuberculosis, blindness, hearing defects, epilepsy, cerebral palsy, muscular dystrophy, multiple sclerosis, diabetes, and mental illness. It was not possible to hear testimony on a host of other diseases. Most of the discussions, however, were broad enough to appear to be equally applicable to the whole field of medicine and public health.

A brief summary of the conclusions and recommendations made by the witnesses to the committee is found at the beginning of the report. Following the summary is a note on how the hearings were conducted, including a listing of all witnesses who testified in this part of the health inquiry.

The main body of the report has two parts. Part I contains the essential views of the witnesses broken down into three major categories: the toll of disease, the research attack against disease, and the prevention and control of disease. Part II assembles the testimony of the witnesses by disease category: heart disease, cancer, mental illness, neurological and sensory disorders, arthritis and rheumatism, diabetes, tuberculosis, and poliomyelitis.

This preliminary report does not purport at this time to reflect conclusions or recommendations of the committee. It is presented now only as the testimony received by the committee. It contains statements and opinions of qualified persons on subjects which are close to the heart of the people and timely for the consideration now being given to our public health. The committee, with a deep and continuing interest in the whole field of health, is concerned that the many problems posed by its current health inquiry shall not go unsolved. This document reflects some of those problems.

CHARLES A. WOLVERTON, *Chairman.*

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SUMMARY OF THE TESTIMONY

THE BURDEN OF DISEASE

Disease imposes on the Nation an economic burden—partly visible and partly hidden—of major proportions.

While there exists no fully accurate measure of that burden, some of the major elements of cost can be clearly identified. For example, the annual tax bill for care of the mentally ill in public institutions is $1.1 billion, and the cost is increasing at the rate of $100 million each year. Tax-supported tuberculosis hospitals cost $630 million per year. Pension and compensation payments to veterans with heart disease disabilities amount to $168 million per year.

These costs are visible. Added to them is the even larger hidden burden that takes the form of lost manpower to industry and to the Armed Forces, lost production, lost wages, lost income tax. The cases of cancer alone that were diagnosed in 1953 have been estimated to cost society $12 billion in lost goods and services. More than $2 billion was estimated to have been lost in 1951 in productivity as a result of heart disease. Arthritis, which cripples approximately 10 million people and permanently disables 1 million, costs the Federal Government more than $75 million a year in income taxes because of wage earners unable to work. In World War II, more than 2½ million men were lost to the Armed Forces—either rejected before induction or discharged afterward—because of mental disorders.

In addition, disease imposes on many individuals and families an economic burden that is often unbearable without extensive outside help. Few families can afford from their own resources to pay the $4,380 involved in hospitalization of a chronic heart patient for 1 year. The $10,000 cost per year of keeping a patient in an iron lung is a fantastic sum for virtually all patients. The monthly cost at a cerebral palsy center offering the full range of medical, psychological, and social services may average as much as $750 per child.

Taken together, these visible and hidden costs of disease are catastrophic in human as well as economic terms. They break and shatter families. They are matters of grave concern for the States and local communities. And, for the Nation as a whole, they constitute a real and serious threat to continued progress along the path leading to strength and security.

THE RESEARCH ATTACK

The most promising weapon now available for attack upon disease is through a national medical research program that will progressively produce means of treatment and ultimately determine causes and open the way to prevention and cure of disease.

Substantial progress has been made in dealing with diseases previously considered incurable. This is attributable in large measure to

the remarkable increase in the total medical research effort of the Nation since 1945. This expansion has seen the growth both of research related to specific diseases and more basic research on underlying causes of disease. Expansion of support for medical research has been from both private and Federal sources, and the Federal aid has stimulated rather than replaced private support.

The States might appropriately undertake wider responsibility for research. However, that does not relieve the necessity of continuing and extending Federal support of medical research in the universities, medical schools, hospitals, and other nonprofit laboratories of the Nation.

Maintenance of the variety of existing sources of support for all kinds of medical research appears to be of fundamental importance. The public and private agencies supporting medical research have established relationships that ensure productive cooperative effort and preclude unnecessary duplication of effort

There is no curtailment of the freedom of individual investigators or interference with their scientific work by Federal or private research-supporting agencies. On the other hand, such research support has tended to influence the direction of the Nation's medical research effort toward basic and applied research in those chronic disease areas (such as cancer, heart, neurology, arthritis, etc.) that are becoming progressively more important and for which support can be most readily obtained.

Although the general picture of progress is encouraging, wide and important gaps in knowledge remain to be filled in. In no field of research are funds adequate to permit investigators to follow all the leads which warrant immediate study. A diversified scientific approach to medical research is essential, with support provided on a scale sufficient to permit both laboratory and clinical work and with fredom to shift emphasis at any stage as dictated by the needs of science.

In this connection, the prevailing research project form of support by private and public agencies may need revamping. Even though this system has been extensively modified so that support for research is normally for periods longer than 1 year, the existing system still does not provide the flexibility required if the efforts of investigators are to be most productive nor the degree of continuity required for complex investigations.

The whole area of medical research would derive great benefit from more intensive efforts to uncover the ultimate basic processes which explain health and disease. It is a matter of high priority to expand such work.

Experts in research related to specific diseases generally are of opinion that there is a basic need for a strong advanced educational system as the indispensable underpinning for all medical research.

A threat to future progress in medical research arises from inadequate attention to the training of manpower. Manpower shortages are developing in many fields, particularly in the medically related sciences. While the existing corps of competent investigators can productively use additional funds, planning aimed toward the expansion of the Nation's future supply of medical research manpower, both basic research investigators and research physicians, is a matter of

utmost urgency. In part, the impending manpower shortage is the result of the financial crisis faced by many universities and medical schools, which are now unable to finance an adequate number of secure and rewarding full-time senior faculty positions. This problem could be substantially alleviated by provision of funds for research positions having tenure and stability.

There is a relative paucity of fellowships and other forms of financial aid to draw and keep able younger people in medically related research. In addition, universities and medical schools, considered as a whole, are not now financially able to construct badly needed research and teaching facilities.

In summary, the two outstanding medical research needs are (1) to attract more persons of ability into research careers related to medicine, and (2) to improve the present methods of supplying support for research and its related needs.

THE ATTACK ON DISEASE BY PREVENTION, CONTROL, AND REHABILITATION

More is now known about the prevention and control of many diseases than is being applied. Research in many fields has provided a stockpile of detection, diagnosis, and treatment methods that are not being fully utilized. As one example, almost half of all cancer can be cured if it is detected and treated in the early stages; yet of this half, only half is being cured. As another example, the fully effective application of known control measures could virtually eliminate tuberculosis as a major health problem, even though improved methods of treatment are needed.

Failure to apply existing knowledge can be traced to many sources, and success in fully applying knowledge will depend on a broad attack. Too few people know the early symptoms of chronic disease. This is a problem of public education. Too few of those who do are inclined to do anything about it. This is a problem of motivation. Too few of those who are motivated have good diagnostic help available to them at a price they can afford. This is a problem of medical economics.

Public and private agencies have undertaken an educational program that is producing results. Bringing venereal diseases, cancer, and mental illness out of the realm of superstition and conspiratorial silence has been a public health achievement of the first magnitude. However, statistics demonstrating the gap between cases curable and cases cured prove that much more remains to be done.

Since some diseases cannot, with existing knowledge, be prevented and since many diseases leave lasting disabilities, rehabilitation should be a major weapon in dealing with disease.

Rehabilitation pays economic dividends. The 67,000 handicapped people rehabilitated by the Federal-State program of rehabilitation earned $16 million per year before and $116 million per year after rehabiliation. However, the Nation is collecting only a small part of this dividend. For example, $70 million per year is spent for public assistance payments and medical care of the blind, but only $12 million per year to rehabilitate the blind. The rehabilitation job remaining to be done is so large that it must be a joint public-private effort.

It is evident that serious gaps exist in our statistical information on disease—the number of deaths per year, the number of people ill or disabled at any one time, the cost of disease to individuals and families, and so forth. The information that is available seems adequate to establish quite firmly the magnitude of the disease problem and the desirability of more intensive efforts to prevent, control, and cure disease. But the number of persons afflicted with some diseases is only an informed guess. The time period for which information is available differs from disease to disease. The criteria for and means of measuring the economic effect of diseases vary from disease to disease. It may well be that the Nation needs a comprehensive study of the health status of its citizens, conducted scientifically to provide a detailed and reliable measure of the disease problem and repeated at intervals frequent enough to give the Nation a reasonably current picture of its health.

PROGRESS AND GOALS IN FIGHTING DISEASE

The first objective of this portion of the health inquiry was to secure a clear picture of the major diseases themselves—what the disease processes are, how diseases affect people physically and emotionally, the extent to which specific diseases may be prevented, halted, ameliorated, or cured, and the outlook for further advances.

The testimony of physicians and medical research experts made clear the infinite diversity of disease and the wide variations in our present ability to cope with disease.

Nevertheless, progress toward effective treatment of many diseases has been rapid during the past few years. A number of diseases formerly considered incurable can now be cured. Even where cure is as yet impossible, the effects of many diseases can be eased and life extended.

A full understanding of the underlying cause of many diseases—such as cancer, heart diseases, mental illness, and neurological disorders—appears to be years and in some cases decades in the future. But a great deal of progress is possible without full knowledge of the cause.

More is now known about disease than is being applied. To achieve maximum progress, the research attack must be continued and new emphasis placed on efforts to translate knowledge into improved medical and public health practice.

Some of the highlights of testimony relating to specific diseases appear below:

Heart disease

Remarkable changes have taken place in the attitude of both physicians and the public toward heart disease. Fear and fatalism were, until recently, the prevailing attitude; a verdict of heart disease was considered tantamount to a death sentence. This has been drastically changed. More knowledge has been won in recent years than had been gained in all the centuries before.

Today, there is a strong and growing awareness that heart disease, which causes 1 out of every 2 deaths and numbers some 10 million sufferers, is not unconquerable. There is increasing recognition that something can be done now about heart disease.

Treatment with the sulfa drugs or antibiotics can halt the strep infection responsible for rheumatic fever and rheumatic heart disease. People with these diseases can be protected significantly against recurrences by daily treatment with these drugs. But this treatment is expensive, and it is difficult for patients to keep up the treatment. The final answer has not been found. Heart valve deformities often found in people with old cases of rheumatic heart disease can be corrected by new surgical techniques.

Drugs that can effectively lower blood pressure without producing severe reactions in patients have been recently developed. But more effective, cheaper, longer lasting, and less toxic drugs still have to be developed.

Drugs to prevent the formation of crippling and killing blood clots that often form and break loose in the veins of people with high blood pressure have been developed. These improved anticoagulants are saving many lives.

And intensive and promising search for the biochemical and metabolic abnormalities responsible for high blood pressure is in progress in many laboratories, but the answer is not in sight.

Research is making clear the fact that such things as protection of the mother against virus infections and excessive radiation exposure (X-rays, for example) during the early months of pregnancy, application of new knowledge with respect to dietary requirements, and improved treatment of glandular disturbances can prevent a large proportion of congenital heart defects. Meanwhile, new surgical techniques permit the correction of a substantial proportion of the congenital defects that have not been prevented.

These accomplishments, although important, are small in comparison with the job that remains to be done. The basic causes of the most common types of heart disease, hardening of the arteries and high blood pressure, remain unknown. Their discovery, and the progress in prevention and treatment that will follow, remain in the future. There is, however, confidence that with a continuing, strengthened, nationwide attack, much if not all of the untimely death and disability from heart disease can be mastered, it is hoped, within a relatively limited number of years.

Cancer

The net effect of recent advances in diagnosis and treatment of cancer is to make possible the cure of half of all cancers if the cancer is detected in the early stages. But of this potential cure rate, only half are actually being diagnosed and treated early enough to effect a cure.

Radioactive isotopes permit more effective treatment of many forms of cancer than is possible with machine-produced X-rays.

New surgical techniques—such as removal of adrenal glands for advanced breast and prostate cancer, together with administration of hormones to substitute for the glands—add to the life of victims of this form of the disease.

Cancer of the blood—leukemia—can be kept under control for months and in some cases for years, even though a cure for the disease is not available.

New diagnostic tests that are simple and specific permit very early diagnosis of cancer of the cervix and uterus. Since surgery can cure

the great bulk of cancers of this type in the early stages, disappearance of this form of disease is now largely a matter of early diagnosis and treatment.

On the other hand, prevention of all forms of cancer and cure of all detected cancers are now future goals. Research—intensive and continuing—is the major hope over the long pull.

Mental illness

Although the causes of the major mental illnesses are still unknown, rapid strides have been made in the effective treatment of the mentally ill. Today, 60 percent of all patients admitted to State mental hospitals with a diagnosis of schizophrenia are released within 1 year. Improved techniques and therapies make it possible to return to their communities two-thirds of patients with involutional psychosis within 1 year of hospitalization. Considerable advances have likewise been made in the extent to which persons suffering from mental deficiency can be trained to lead a socially useful life.

New knowledge about the part played by environmental stress in contributing to mental and emotional disorders, as well as to such organic complaints as hypertension, arthritis, and ulcerative colitis, is making it possible to handle such problems successfully. Improved scientific techniques and tools are being used to increase understanding of the structure and functioning of the human brain and nervous system. Much, however, remains to be learned about the causes, diagnosis, and treatment of mental disease.

Scientists believe that the answers to many of the unsolved questions about mental illness will be found in a broad spectrum of activity, ranging from anatomy of the brain to the cumulative psychological experiences of the individual throughout his life. To find the answers, more laboratory and clinical research, and more trained people to carry on the research and provide the treatment and preventive work are needed.

Neurological and sensory disorders

The possibility of resolving the problem of multiple sclerosis within the immediate future is not as promising as desired. The cause of the disorder is still unknown, and research has not even been able to eliminate several of the possible suggested etiological factors (such as allergy or a virus). With no treatment available, the fate of the multiple sclerotic has not changed materially since the disease was first observed in 1835 .

The marked increase of research interest in this disorder, however, combined with the availability of new research techniques which make it feasible to study the structure, growth, and function of the myelin (the fatty sheathing of the nerve fibers destroyed in the course of multiple sclerosis) hold considerable hope for future enlightenment concerning this problem.

Approximately 80 percent of all seizures may be partially or wholly controlled by drugs or by surgery. Only 20 percent, however, of the Nation's one and a half million epileptics receive adequate treatment, a problem which is created partially by the inadequacy of medical facilities and personnel, but mostly by the prevalent social prejudice whereby the epileptic hesitates to identify himself as such.

The main resolution of the problem of epilepsy seems to lie in the development of a cure for seizure. Promising leads in this direction

are found in recent, rapid developments in the understanding of the chemistry and metabolism of epileptic tissue, with the inherent possibility existing, thereby, for correcting these abnormalities.

Within the past 3 or 4 years, the development of total rehabilitation procedures has been responsible for bringing a minority of the cerebral palsied to some degree of independent self-care. The possibility for extending these services to all those who may profit by them within the near future seems remote because the expenses of rehabilitation are great, and there is a dearth of medical and paramedical personnel trained to handle the enormous patient load.

Some preventive procedures have been instituted in relation to pregnancy and child-birth care, but these do not seem to have appreciably diminished the numbers of cerebral palsied born each year (10,000). Research in treatment has been initiated only within the past 2 or 3 years, and while there is a good deal of promise in such studies as those on the regeneration of nerve tissue, it cannot be predicted when these findings will be applicable to cerebral palsy.

Only in recent years has muscular dystrophy been recognized as an extensive public health problem. There are approximately 100,000 cases of the disorder in the United States, more than half of which are children destined to die before maturity. There is no treatment for muscular dystrophy, no means of prevention. In a limited number of adult cases, where progression of the disease is slow, rehabilitation is sometimes useful.

While research on this disorder has only begun, previous fundamental studies on the nature of normal neuromuscular activity provides a solid basis for understanding abnormal function, and it seems probable that within the next decade considerable light will be shed not only on the causes of muscular dystrophy but on other neuromuscular disorders as well.

Progress in the treatment of the blinding eye disorders has proceeded with remarkable speed in the past decade. The development of surgical procedures for cataract and glaucoma which can control their insidious progress ,the use of ACTH and cortisone in the treatment of more than a dozen other diseases of the eye, and the development of corneal transplant techniques represent some of the progress which has helped control the incidence of blindness in the United States.

Nevertheless the numbers of the blind continue to grow larger, putting a still greater burden on the inadequate facilities which have been established to serve them. It is clear that measures for the prevention of blindness and research into cures for blindness must be increased.

The problem of deafness has probably received less attention than any other major medical problem in the United States. There are 760,000 totally deaf in the United States, with another 3,500,000 who are partially so. Yet relatively little effort has been devoted to study of methods of treating disorders of the ear, with less than $200,000 being devoted to such research. The chief efforts have been focused on the development of better hearing aids, and within industry greater effort has been made to protect personnel in jobs where hearing may be adversely affected. It is clear that methods of prevention can still be improved; but the great need is for research leading to new methods of treatment.

Arthritis and rheumatism

Arthritis and other rheumatic diseases afflict approximately 10 million Americans, of whom about 1 million are permanently disabled. The medical and socio-economic problem is usually underestimated by the public and physicians alike.

With very few exceptions, these are conditions of which the cause and cure are unknown. The recent discovery, however, that rheumatoid arthritis, the most serious rheumatic disease, responds to treatment by hormones such as cortisone opens many new doors in research. Investigators consider that this discovery launched a new era in medical science.

Although rheumatic conditions are usually incurable, most patients could benefit by known methods of treatment, such as hormone administration and physical therapy. Control is impeded by a shortage of specially trained physicians and allied workers and by inadequate facilities.

Intensive research, both laboratory and clinical, including fundamental studies in biochemistry, would probably lead to means of preventing or curing most arthritis that has not progressed to an irreversible stage.

Diabetes

Diabetes is a chronic disease afflicting approximately 2 million Americans. New cases number at least 60,000 annually, and the incidence will probably increase in the future.

To some extent, the disease can be controlled by insulin and diet. Insulin has increased the diabetic's life span by 3 or 4 times, and extensive efforts are being made to bring the unknown diabetics under treatment. Complications such as blindness, however, are serious problems, and their control is extremely difficult. Moreover, a serious shortage of insulin, now made only from animal glands, is likely to develop.

The disease offers great opportunities for research. Although the cause is unknown, the fundamental disorder lies in the body's mechanism for utilizing sugar, and the science of biochemistry is making substantial progress in that field. Insulin cannot be produced synthetically at present, but intensive fundamental research in chemistry might show the way to synthesize it or yield an effective substitute.

It is reasonable to assume that long-term, intensified research will lead to an understanding of the cause of diabetes, a means of preventing it, and even a cure.

Tuberculosis

Although deaths from tuberculosis have been dramatically reduced, this disease remains the seventh leading cause of death and the only communicable disease among the first 10 causes. There are roughly 1,200,000 people in this country with tuberculosis, of whom 500,000 are known to their health departments.

The exact mechanism by which contact with the tubercle bacillus results in serious lesions of tuberculosis in some persons is not yet known. Good leads are at hand, but methods for following them to the desired end have not been developed.

The primary needs in tuberculosis are for improved therapeutic drugs, better tests to determine if individual cases are active or in-

active, a superior vaccine, and knowledge of how tuberculosis spreads from man to man.

In recent years the treatment of tuberculosis has been enormously improved. New drugs, new surgical techniques, and improved diagnostic aids have brought about advances which would make possible the virtual eradication of the disease if all the knowledge now available could be effectively applied.

Poliomyelitis

In the field of poliomyelitis, the most notable progress in the last few years has been in the development of preventive measures.

Results reported in 1953 supply significant hope that an effective vaccine will be available for general use within a few years. The year 1954 will see the initiation of large-scale trials in children of an inactivated virus vaccine under the auspices of the National Foundation for Infantile Paralysis. The vaccine is the work of a National Foundation grantee at the University of Pittsburgh.

No one can now say whether the poliomyelitis vaccine which will find eventual acceptance will be this vaccine, or a modification of this vaccine, or an entirely different vaccine. But enough is known to justify belief that an effective weapon is near at hand.

The other major advance against poliomyelitis concerns gamma globulin. This derivative of human blood was shown in field tests to have limited preventive value from the end of the first week through the fifth week after injection. On the basis of these results, gamma globulin was distributed to the States on a quota basis in 1953 for use incombatting poliomyelitis epidemics. Because its protection lasts only a few weeks, gamma globulin is viewed as an interim weapon pending the development of a true vaccine.

A NOTE ON THE CONDUCT OF THE HEARINGS

This preliminary report of the House Committee on Interstate and Foreign Commerce is based on four volumes of printed testimony, October 1–12, 1953. The hearings which gave rise to this testimony were conducted in an unusual fashion. Panels of expert witnesses were given a free hand to discuss specific aspects of the diseases in which they were interested, as well as to exchange views on other matters relevant to their areas of work. The committee observed, questioned, and guided the discussions in general terms. The outcome was an extraordinarily informative and pertinent testimony, so broad and so rich in information and judgments that a summary can scarcely do it justice.

Nevertheless, testimony on a number of important points was emphatic and repeated independently by a number of prominent and well-informed scientists and laymen. These points seem relevant to congressional deliberations and at the same time appear to deserve wide dissemination as a matter of public education.

The witnesses before the committee represented a diversity of public and private groups, as well as the individual points of view which are so essential if any problem to be placed before the Congress is to be seen in its entirety.

A complete list of the witnesses follows:

Heart disease:

Andrus, Dr. E. Cowles, president-elect of the American Heart Association; associate professor of medicine at Johns Hopkins University; physician in charge of the adult cardiac clinic at Johns Hopkins Hospital.

Berliner, Dr. Robert W., chairman, committee of laboratory chiefs, National Heart Institute, Public Health Service.

Betts, R. O., executive director, American Heart Association.

Jones, Dr. T. Duckett, medical director, Helen Hay Whitney Foundation, New York City; vice president of the Helen Hay Whitney Foundation; vice president of the American Heart Association and a member of the advisory committee of the National Heart Institute called the National Advisory Heart Council.

McCormick, Dr. Edward J., president, American Medical Association; engaged in the active practice of medicine in Toledo, Ohio.

Perdue, Dr. Jean Jones, member of the board of directors of the Miami Heart Institute, a member of the board of directors of the Miami Heart Association and a practicing physician in Miami Beach, Fla.

Watt, Dr. James, Director of the National Heart Institute, Public Health Service.

Wilkins, Dr. Robert W., associate professor of medicine, Boston University School of Medicine; director of the cardiovascular research laboratories at the Evans Memorial Hospital, Boston, and vice president of the American Heart Association.

Wright, Dr. Irving S., past president, American Heart Association; professor of clinical medicine, Cornell University Medical School.

Cancer:

Brucer, Dr. Marshall, Director, Medical Division, Oak Ridge Institute of Nuclear Studies.

Bugher, Dr. John C, Director of the Division of Biology and Medicine of the Atomic Energy Commission; formerly with the Rockefeller Foundation, New York City.

Cancer—Continued

Cameron, Dr. Charles S., medical and scientific director of the American Cancer Society; clinical assistant surgeon at the Memorial Hospital and the James Ewing Hospital in New York City.

Cannan, Dr. R. Keith, chairman of the Division of Medical Sciences of the National Research Council.

Doan, Dr. Charles, dean, College of Medicine, Ohio State University, Columbus, Ohio.

Dunham, Dr. Charles L., Chief, Medical Branch, Division of Biology and Medicine, Atomic Energy Commission.

Farber, Dr. Sidney, scientific director of Children's Cancer Research Foundation, Boston; professor of pathology, Harvard Medical School; member of National Advisory Cancer Council.

Godwin, Dr. John T., pathologist for the medical department of the Brookhaven National Laboratory on Long Island.

Granger, Dr. Gordon A., Acting Medical Director of the Food and Drug Administration.

Hasterlik, Dr. Robert, Argonne Cancer Research Hospital, Chicago, affiliated with the University of Chicago.

Heller, Dr. John R., Director, National Cancer Institute, Public Health Service.

Mider, Dr. G. Burroughs, Associate Director in Charge of Research, National Cancer Institute, Public Health Service.

Meader, Dr. Ralph, Chief of the Cancer Research Grants Branch, National Cancer Institute, Public Health Service.

Nathanson, Dr. Ira T., associate clinical professor of surgery at Harvard Medical School; director of Massachusetts division of American Cancer Society; member of the staff of Huntington Laboratories; chairman of National Research Council's Committee on Cancer Diagnosis and Therapy.

Rhoads, Dr. Cornelius P., scientific director of the Memorial Center for the Treatment of Cancer and Allied Diseases, New York City; director of the Sloan Kettering Institute for Cancer Research; professor of pathology at Cornell University College of Medicine.

Rottino, Dr. Antonio, director of laboratories and pathologist for St. Vincent's Hospital, New York City; director of Hodgkin's research at St. Vincent's Hospital; member of advisory committee of the Damon Runyon Foundation.

Runyon, Mr. Mefford, executive vice president of the American Cancer Society.

Teeter, Mr. John, Damon Runyon Foundation, New York, N. Y.

Warren, Dr. Shields, First Director of the Division of Biology and Medicine of the Atomic Energy Commission; now professor of pathology at Harvard Medical School and pathologist to the Deaconess Hospital in Boston.

Wermer, Dr. Paul L., secretary, committee on research, American Medical Association, Chicago, Ill.

Mental illness:

Blain, Dr. Daniel, medical director of the American Psychiatric Association; clinical professor at Georgetown University School of Medicine. Formerly director of the Psychiatric and Neurology Services of the Veterans' Administration; member of the expert committee on mental health of the World Health Organization and consultant to the Public Health Service and the Veterans' Administration.

Braceland, Francis J., director of the Institute of Living, Hartford, Conn.; clinical professor of psychiatry at Yale University. Formerly dean of a medical school; and wartime chief of psychiatry for the United States Navy; head of psychiatry at the Mayo Clinic. Secretary and president of the American Board of Psychiatry and Neurology.

Felix, Dr. Robert H., Director of the National Institute of Mental Health, Public Health Service; clinical professor of psychiatry at Georgetown University; on the faculty of the department of public health at George Washington University.

Kety, Dr. Seymour S., Associate Director in Charge of Research of the National Institute of Mental Health and of the National Institute of Neurological Diseases and Blindness; professor of clinical physiology at the University of Pennsylvania.

Mental illness—Continued

Sanford, Dr. Fillmore H., executive secretary of the American Psychological Association; psychologist. Formerly engaged in teaching and research at Harvard University, the University of Maryland, and, most recently, at Haverford College.

Schlaifer, Mr. Charles, co-chairman of the National Mental Health Committee; formerly member of the National Advisory Mental Health Council; member of the board of directors of the National Association of Mental Health; president of an advertising agency.

Stevenson, Dr. George S., associated with the National Association for Mental Health as medical director. Formerly president of the American Psychiatric Association and consultant to a number of Government agencies: Selective Service, the State Department, Labor Department, Public Health Service, Children's Bureau, and Office of Vocational Rehabilitation.

Willey, Dr. Richard, executive assistant for the American Psychological Association; formerly research associate for the Council of State Governments.

Wortis, Dr. Sam Bernard, professor of psychiatry and neurology at New York University College of Medicine; director of the psychiatric and neurologic services of the university hospital at the New York University Bellevue Medical Center; consultant to several Federal agencies and several hospitals in the general metropolitan area of New York. Formerly president of American Board of Psychiatry, the American Neurologic Association, and several other medical and neuropsychiatric organizations in America; served a 3-year term as a member of the National Advisory Mental Health Council.

Neurological and sensory disorders:

Bailey, Dr. Pearce, Director, National Institute of Neurological Diseases and Blindness, Public Health Service; clinical professor of neurology, Georgetown University, Washington, D. C.

Brooks, Dr. Glidden L., medical director of the United Cerebral Palsy Associations; fellow of American Academy of Pediatrics.

Elstad, Leonard M., LL.D., president, Gallaudet College, Washington, D. C.

Foote, Dr. Franklin M., physician; executive director of the National Society for the Prevention of Blindness, New York City. Formerly assistant professor of preventive medicine at Cornell Medical College.

Forster, Dr. Francis Michael, professor of neurology and dean of the Georgetown University School of Medicine; a past president of the American League Against Epilepsy.

Glorig, Dr. Aram, Chief of the Army Audiology and Speech Correction Center at Walter Reed Army Hospital; member of several societies which have to do with hearing and its ramifications.

Gruber, Miss Kathern F., assistant director, American Foundation for the Blind, Inc.

Hardy, Dr. William, director of Johns Hopkins Hospital hearing and speech center; on the faculty of the School of Medicine and Hygiene.

Johnson, Dr. V. L., professor of ophthalmology, Western Reserve University School of Medicine.

Kety, Dr. Seymour, Associate Director in Charge of Research, National Institute of Neurological Diseases and Blindness, Public Health Service.

Milhorat, Dr. A. T., chairman of the medical advisory board of the Muscular Dystrophy Association of America; associate professor of medicine, Cornell Medical College, and attending physician for the New York Hospital and president of the New York State Board of Medical Examiners.

Owen, Carl M., member of the executive committee of the National Multiple Sclerosis Society. Senior partner of the law firm of Wilkie, Owen, Farr, Gallagher & Walton, New York.

Sands, Dr. Harry, executive director, Epilepsy Association of New York.

Shy, Dr. G. Milton, Clinical Director, National Institute of Neurological Diseases and Blindness, Public Health Service; associate clinical professor in neurology, Georgetown University.

Stone, Dr. Frederick L., Chief, Extramural Programs, National Institute of Neurological Diseases and Blindness, Public Health Service.

Tankersley, Mrs. Ruth McCormick, president of the National Epilepsy League.

Neurological and sensory disorders—Continued

Traeger, Dr. Cornelius, doctor of medicine and consultant medical director of the National Multiple Sclerosis Society; consultant physician of Roosevelt Hospital; attending physician at the Hospital for Special Surgery; fellow of the American College of Physicians; fellow of the Academy of Medicine and the New York Academy of Science; member of the advisory council for the National Institute of Neurological Diseases and Blindness.

Van Meter, Mr. Karl K., executive director of United Cerebral Palsy Associations.

Walker, Mr. Hulan, National Council to Combat Blindness, Inc.

Weisenfeld, Miss Mildred, executive director, National Council to Combat Blindness, Inc.

Arthritis and rheumatism:

Bunim, Dr. Joseph J., Chief of the Arthritis and Rheumatism Branch of the National Institute of Arthritis and Metabolic Diseases, Public Health Service; formerly engaged in the study of rheumatic diseases at New York University.

Daft, Dr. Floyd S., Director, National Institute of Arthritis and Metabolic Diseases, Public Health Service.

DeForest, Dr. Gideon K., associate clinical professor of medicine, Yale University Medical School, chief of the arthritis clinic; medical director of the Arthritis and Rheumatism Foundation.

Freeman, Mr. Thomas, executive director of the Arthritis and Rheumatism Foundation.

Kenney, Gen. George C., president, Arthritis and Rheumatism Foundation, New York City.

McEwen, Dr. Currier, dean, New York University College of Medicine; past president of the American Rheumatism Foundation.

Ragan, Dr. Charles, associate professor of medicine at the College of Physicians and Surgeons, Columbia University; president, American Rheumatism Association; in charge of the Faulkner Arthritis Clinic at Presbyterian Hospital in New York.

Diabetes:

Connelly, Mr. J. Richard, executive director of the American Diabetes Association.

Kurlander, Dr. Arnold B., Assistant Chief of the Division of Chronic Disease and Tuberculosis, Public Health Service.

Reed, Dr. John A., practicing physician; secretary of the American Diabetes Association.

Sprague, Dr. Randall G., president, American Diabetes Association; associated with the Mayo Clinic and the Mayo Foundation.

Wilkerson, Dr. Hugh L. C., Chief of the Diabetes Section, Division of Chronic Disease and Tuberculosis, Public Health Service.

Tuberculosis:

Anderson, Dr. Robert, Chief, Division of Chronic Disease and Tuberculosis, Public Health Service.

Barnwell, Dr. John B., Director of the Tuberculosis Service of the Veterans' Administration central office. Formerly associate professor of medicine of the University of Michigan, and physician in charge of the tuberculosis unit.

Funkhouser, Mr. Edward, executive secretary of the local District of Columbia Tuberculosis Association.

Karel, Dr. Leonard, chief, extramural program, National Microbiological Institute; and for 3 years prior to that associated with the National Institutes of Health's Division of Research Grants and Fellowships, Public Health Service.

Leahy, Mr. William E., director in both the national and local tuberculosis associations; chairman of the seal sales drive.

Long, Dr. Esmond R., director of medical research of the National Tuberculosis Association; director of the Henry Phipps Institute of the University of Pennsylvania, an institution for tuberculosis research.

Tuberculosis—Continued

Perkins, Dr. James E., managing director of the National Tuberculosis Association; formerly deputy commissioner of the New York State Department of Health.

Stocklen, Dr. Joseph B., director of tuberculosis controls for Cuyahoga County, Cleveland, Ohio.

Towey, Dr. John, superintendent of the Pine Crest Sanatorium at Powers, Mich.; director of the National Tuberculosis Association.

Poliomyelitis:

Anderson, Dr. Gaylord, director, School of Public Health of the University of Minnesota; chairman of the medical advisory committee on polio in the State of Minnesota.

Andrews, Dr. Justin M., Associate Chief, Bureau of State Services, Public Health Service.

Aufranc, Dr. Will H., Director, Health Resources Staff, Office of Defense Mobilization; formerly Acting Chief, Venereal Disease Division, Public Health Service.

Barrows, Mr. Raymond H., executive director of the National Foundation for Infantile Paralysis; formerly in administrative work of the American National Red Cross.

Elwood, Dr. Paul, director, inpatient service, Sister Elizabeth Kenny Foundation.

Grant, Gen. David N. W., director of blood program, American National Red Cross. As air surgeon, United States Air Force, during World War II, was responsible for scientific research which solved many medical and physical problems encountered by airmen in high-altitude flying.

Haas, Dr. Victor H., Director of the National Microbiological Institute, Public Health Service.

Hammon, Dr. McDowell, head of the department of epidemiology and microbiology at the University of Pittsburgh Graduate School of Public Health; diplomate of the American Board of Preventive Medicine and Public Health.

Jungeblut, Dr. Claus, professor of bacteriology, Columbia University; associated with the Kenny Foundation.

Kline, Mr. Marvin L., executive director, Sister Elizabeth Kenny Foundation.

Langmuir, Dr. Alexander D., Chief, Epidemiology Branch, Communicable Disease Center, Public Health Service.

Norton, Dr. J. W. R., State health officer, North Carolina State Board of Health.

Paffenbarger, Dr. Ralph S., Jr., epidemiologist, Division of Civilian Health Requirements, Public Health Service.

Paul, Dr. John R., professor of preventive medicine, Yale University School of Medicine.

Price, Dr. David E., Assistant Surgeon General of the Public Health Service; formerly associate director of the National Institutes of Health in charge of programs of grants for research and training.

Sabin, Dr. Albert B., professor of research pediatrics at the University of Cincinnati College of Medicine; formerly at the Rockefeller Institute.

Stokes, Dr. Joseph, physician in chief, Children's Hospital, Philadelphia, Pa.; president, Society for Pediatrics Research.

Switzer, Miss Mary, Director of the Office of Vocational Rehabilitation, U. S. Department of Health, Education, and Welfare.

Van Riper, Dr. Hart E., medical director of the National Foundation for Infantile Paralysis.

Wise, Dr. Charles, professor of physical medicine and rehabilitation, George Washington University College of Medicine, Washington, D. C.

Part I

General Discussion by and Recommendations of the Witnesses

CHAPTER I

THE BURDEN OF DISEASE

This chapter consists of excerpts from the testimony indicating in some detail the magnitude of the disease problem. Disease by disease, the witnesses spelled out the problem in terms of the number of people afflicted, the number of premature deaths, the number of people crippled, the cost of illness to the individual and his family, and the cost of disease to the Nation in terms of lost production, lost manpower, and the tax burden for medical care.

This dismal catalog omits a most important aspect of disease that cannot be reduced to statistics—sheer human pain and misery, not only of the victims of disease but of their families.

The cumulative effect of the testimony appears to outline a national problem of the first magnitude.

A. HEART DISEASE

Heart disease is the leading cause of death in the United States. It causes more than 1 out of every 2 deaths each year. More than 785,000 people died in this country from heart disease in 1953.

The impact of heart disease becomes more apparent when it is assessed according to age groups. It is the leading cause of death among children. It causes one-sixth of all deaths in the military ages, 20 to 39. It causes one-third of all deaths in the most productive years, age 35 to 54. It causes one-half of all deaths in the ages 55 to 74, and far more than one-half of the deaths in those 75 and over.

In terms of manpower and economic loss, about 80,000 men were given disability discharges or died in service from heart disease in the war years 1942–45. Rheumatic fever alone immobilized more than 40,000 men in the Armed Forces during World War II.

At least 653,000 man-years are lost each year to industry alone because of heart disease disabilities. About $2,124 million was estimated to have been lost in 1951 in productivity as a result of heart disease.

Compensation and pension payments to veterans in 1950 because of heart disease disabilities were $168,250,000.

The proportion of insurance claim payments for deaths from heart disease has been steadily rising, one company report shows. In 1951, one major company paid to beneficiaries on account of heart disease a total of $173,680,000. This sum was about 3½ times the amount paid in 1931.

At a hospital rate of $12 a day, one patient with chronic heart disease costs $4,300 a year to maintain. This means that if 50,000 patients with heart disease received hospital care for a year, the cost in 1 year would be $219 million.

Heart disease incapacitates about one-fourth of the persons who are beneficiaries of the federally aided program of assistance for permanently and totally disabled persons. (Source: Statement of Dr. Irving Wright, professor of clinical medicine, Cornell University Medical School.)

B. CANCER

On the basis of the number of patients destined to get cancer this year, there will be admitted to hospitals in the United States in the course of this single year 114,530 patients who will stay in the hospital an average of 27 days. According to my multiplication, this means 11,921,310 patient-days in the United States in a single year attributable to cancer. If the cost in a hospital can be averaged at $15 a day for a cancer patient—and that is conservative, I am sure some of my esteemed friends here will say—this means we are paying $178,819,000 a year for treating cancer. (Source: Statement of Dr. Charles Cameron, American Cancer Society.)

We find that since 1900 cancer has come from eighth place in cause of death to second place at this time. While it is primarily a disease of the older age groups, it must be remembered that better than 15 percent of the deaths from cancer occur in individuals under the age of 45.

It is estimated that in 1953 there will be about 224,000 deaths from cancer. There are coming to medical attention each year about 530,000 cases of cancer. It is estimated that at the rate at which we are acquiring cancer, 50 million of the present population of the United States will probably acquire cancer and about 25 million of them will die from that disease.

It is quite apparent that loss of productiveness, particularly on the part of the breadwinner, is a very disrupting and a very important element in our social economy. It is estimated that about $12 billion each year is lost as a result of this loss of productivity.

The estimated average total cost of hospitalization to the cancer patient turns out to be $535. On the basis of the schedule of fees for surgery and supporting services contained in typical Blue Shield plans, an individual from a family of low or moderate income can be expected to pay at least an additional $350 for physicians' services (diagnosis, surgery, radiation, followup care). Individuals normally earning higher incomes would pay considerably more. Thus the average cancer patient hospitalized (3 out of every 4 cases diagnosed) can expect to pay at least $885 for diagnosis and treatment. These estimates are minimal because they do not take into account the cost of care subsequent to hospital discharge (stay in nursing and convalescent homes and medical care in the patient's home).

Slightly more than one-fifth of the patients were unable to make any payment from their own resources toward their hospital bill. More than one-fourth of the patients required some charitable aid in the payment of their bills. (Source: Statement of Dr. John R. Heller, National Cancer Institute, Public Health Service.)

C. MENTAL ILLNESS

The number of mentally ill patients in the United States exceeds the number of patients suffering from any other type of illness. Approximately 50 percent of all hospital beds in the United States (662,500 out of 1,425,000 beds) are needed and used for this group of illnesses * * * and the need for treatment facilities, including both hospitals and clinics, is more acute than in any other field of medicine because of this large, continuing, and enlarging patient load.

Approximately 40 percent of the total Federal budget for health care is for mental health; and approximately one-sixth to one-third of State budgets in our larger States is for the care of the mentally ill.

Personality disorders were the cause of 18 percent of the draft rejections in World War II. This means that 1 out of every 5 men examined was rejected for reasons of mental ill health. In addition, more than 2½ million men were lost to the Nation's Armed Forces through mental and emotional illness and defect, enough men to constitute about 177 Army infantry divisions.

The costs of mental illness to our National are colossal. It is a reasonable estimate that this will run as high as several billions of dollars each year. (Source: Statement of Dr. S. Bernard Wortis, professor of psychiatry and neurology, New York University College of Medicine.)

The cost of taking care of the mentally ill with public funds, including maintenance of such patients in public hospitals, VA pensions, and other State and local mental health activities in 1952, amounted to $1,041 million or about $2,900,000 per day. This is about $2,000 per minute, day and night * * *

Might I point out to you that these staggering figures do not include the costs for psychopathic hospitals, the cost for private mental hospitals, treatment in mental hygiene clinics that are not part of the Veterans' Administration system,

nor do they include the larger and immeasurable cost of economic loss in earning power and the income tax thereon that would be available to the Government and to our Nation of the mentally ill individual and his family. (Source: Statement of Dr. Robert H. Felix, National Institute of Mental Health, Public Health Service.)

D. NEUROLOGICAL AND SENSORY DISORDERS

As a distinct group of disorders, the neurological and sensory diseases create an extremely serious public-health problem. They affect 20 million persons in the United States alone, of whom at least half endure gravely disabling conditions. As a cause of death, it ranks third with cerebral vascular disease, causing 160,000 deaths yearly, and it is estimated that another 50,000 deaths yearly are due to all other neurological and sensory disorders.

It is, however, as the primary cause of permanent crippling that the neurological and sensory disorders are known. Cerebral vascular disease, caused by injuries, infections, and vascular disturbances of the brain, while a serious killer, leaves 1,800,000 now alive and crippled, paralyzing the body or seriously limiting the powers of movement, speech, and vision. And the other neurological and sensory disorders, similarly affecting the brain or spinal cord, are responsible for the disablement of another 8,200,000 persons.

This crippling is so severe and extends over such a long period of time as to cause profound psychological, social, and economic dislocation for the individual suffered. No other group of disorders receives so little medical and research attention; yet no other group of disorders represents such an economic loss to the Nation and the patients and families who must cope with them.

It is almost impossible to gain proper insight into the staggering costs which the neurological and sensory disorders impose on the country. The nature of these disturbances, in the vast majority of cases, renders the victim wholly or partially dependent on family, community, State, and Government. The fact that so many of these conditions have their origin in childhood or early adulthood, and that life, nevertheless, so frequently endures the normal span of years undoubtedly makes these disorders a most tragic personal and family problem.

Some concept of our national economic losses may be given by reviewing a single neurological problem. Statistics derived from the Journal of the American Medical Association indicate that 200,000 persons are absent from full employment every day of every year largely as a result of head injuries caused by industrial and automobile accidents. This represents a loss of 416 million man-hours of work and at an average of $1.50 per hour ($60 weekly), this amounts to wage losses of $624 million a year.

A large majority of the 500,000 who incurred cerebral palsy in childhood will also not enjoy fruitful labor, will not pay income taxes, and cannot serve in the Armed Forces. The cost of maintaining just 50,000 epileptics in State institutions amounts to $35 million yearly. And one insurance company has estimated that the cost in indemnity and continuous hospitalization of a single paraplegic patient will amount to $400,000. While we do not know the exact number of paraplegics in the country, the estimates based on professional spot checks range from 85,000 to 125,000.

In this bewildering array of costs due largely to the crippling effects of the neurological and sensory disorders, the national income as derived by tax revenue is also seriously affected. It has been estimated, for example, that at our present tax rate per capita, the 500,000 cerebral palsied who incurred the disorder in infancy should pay at least $600 each year in income taxes, or a total of $300 million yearly. Over half of these, however, will actually pay no taxes at all and over an average adult productive life span of 30 years, a total of $5 billion in tax revenue will be lost from the cerebral palsied. (Source: Prepared statement of the National Committee for Research into Neurological Disorders.)

In these United States 300,000 men, women, and children alone are totally blind; 300,000 more have visual defects so serious as to create partial or almost total disability. Some of this number will maintain a glimmer of vision through life, but for many of this group the verdict of ultimate blindness has been passed by their doctors and they wait with dread as they gradually watch their sight fade.

In addition, statistics disclose that a million persons are blinded in one eye; that there are probably 800,000 with undetected glaucoma (a dread disease of the eye which can result in blindness), and that the estimated 2 million sufferers

from diabetes whose lives have been prolonged because of the various insulins are now each potential candidates for a disabling eye disease.

Let us look at the situation coldly and practically from the taxpayers' point of view. For the fiscal year 1951, the total amount of Federal, State, and local expenditures for aid to the blind is estimated at approximately $55 million; while in the fiscal year 1953 this estimate is approximately $64 million (reference United States budget over a period of but 2 or 3 years, and does not include the lost revenue to our Federal Government resulting from the annual tax exemption of $600 to each blind individual). It is further estimated that the cost to educate and maintain one blind baby through its lifetime is $100,000. Multiply this by the estimated 4,000 new young victims of retrolental fibroplasia (the disease which causes blindness in premature infants) and the cost of seeing these infants through their lives reaches the staggering figure of $400 million. When one considers Dr. Vail's prediction of 132,500 additional blind by 1955, the potential burden on the taxpayer is appalling. Indeed, gentlemen, the penalty we would have to pay, both in human suffering and in burdensome taxation, would only be consistent with the injustice we commit by our lack of support to ophthalmic research. (Source: Statement of Miss Mildred Weisenfeld, executive director of the National Council to Combat Blindness.)

E. ARTHRITIS AND RHEUMATISM

Arthritis, and its related rheumatic diseases, is more prevalent among our citizens than are cancer, heart disease, tuberculosis, and diabetes combined. In the United States today it afflicts more people, cripples and disables more people, and brings more pain to more people than any other chronic disease.

It disables 10 times as many persons as diabetes, 10 times as many as tuberculosis, and 7 times as many as cancer.

The total number of victims, approximately 10 million, is greater than the combined populations of Chicago and Los Angeles. Of these, this devastating disease has permanently disabled 1 million. The economic cost to the Nation is well over $700 million per year.

Selective Service reports that of the young men called up for service in the Armed Forces in Korea, 30,000 of the 505,000 rejected were unfit for duty because they were afflicted with rheumatic disease.

In the United States, 30 million people—one-fifth of the population, counting the families of arthritics—are affected by the medical, social, and economic aspects of this problem. The manpower lost each year in the United States because of arthritis and rheumatism is estimated as 150 million days, equivalent to an army of over 400,000 persons unable to work at any time.

Over half a billion dollars yearly is lost in wages and salaries by the sufferers from this disease, in addition to the cost of medical care and relief allowances. Medical care alone costs more than $100 million per year. Arthritis brings with it not only pain and crippling, but impoverishment to many of its victims. The Federal Government loses each year $77 million in income taxes because of the wage earners unable to work. In short, arthritis and rheumatism present to us a medico-socio-economic problem of the first magnitude. (Source: A joint statement by the Arthritis and Rheumatism Foundation and the National Institute of Arthritis and Metabolic Diseases, Public Health Service.)

F. DIABETES

On the basis of the data collected in the National Health Survey of 1935–36, supplemented by information obtained in local surveys, in detection campaigns and from other sources, it is estimated that there are at least 1 million known diabetics in this country today. From various studies it appears, however, that the actual number of cases in the country is of the order of 2 million. There are large numbers of persons with diabetes whose disease is undetected.

Of the cases reported in the National Health Survey, approximately one-fourth had been disabled for a week or longer in the survey year. In that year it was estimated that persons with diabetes lost 19,200,000 days from work or other usual pursuits, or approximately 30 days per person with the disease. It was further estimated that there were nearly 35,000 persons who were invalids because of the disease. From these figures, which are much below those prevailing at the present time, it is readily seen that the economic costs of the disease are very substantial. (Source: Statement of Dr. Randall G. Sprague, president of the American Diabetes Association.)

G. TUBERCULOSIS

It is difficult to give precisely the total annual dollar cost of TB. Its implications are widespread and its burden is dispersed throughout a community. It can be said that the cost of dealing with TB—for the individual family within which it strikes, and for the community which must cope with its damaging effects—is staggering. In terms of lost national production alone, TB's toll in 1952 amounted to about $500 million. (In that year, approximately 250,000 Americans of working age were unable to work because of active TB—more than the total labor force of the crude-oil and natural-gas industries in the United States.) The loss to the Nation which resulted from the premature deaths due to TB in 1952, moreover, is estimated at about $1 billion worth of future production.

These, however, are the indirect costs of TB. The more direct costs—those which are cash outlays by agencies in every community of our Nation and by the Federal Government—are estimated at a minimum of $620 million for the year 1952. Of this total, the Federal Government expended more than $300 million. More than one-half of the $620 million went toward the hospitalization of tuberculous patients.

An estimate of the financial burden which TB places upon a family would be unrealistic and misleading, since very few families can by themselves bear the cost of the disease, and since most of the direct costs are actually borne by the community. However, by taking into account the total value of TB expenditures in the United States, the value of production lost annually because of tuberculous illness, the annual loss of future potential earnings, and the number of new, active cases in the United States, we can estimate roughly that each new case of TB costs the Nation a total of some $30,000 in both direct and indirect costs.

Such indexes cannot reflect the serious distress and dislocation which are suddenly imposed on a family when TB strikes one of its members—particularly if the victim of the disease is the breadwinner or the mother of dependent children. Case histories can depict these effects.

The long-continued period of medical care almost invariably involved in tuberculosis drains accumulated savings from most patients and families. In addition to the financial problems, families carry a heavy burden in terms of their psychological needs for the person who is ill and away from home. There is also the burden of financial readjustments, lowered standards of living, assumption of the wage earner's role by somebody else, interrupted schooling, and uprooting of children. (Sourse: Statement of Dr. Robert Anderson, Division of Chronic Disease and Tuberculosis, Public Health Service.)

H. POLIOMYELITIS

The problem in poliomyelitis is crippling; its death rate is relatively low. Since it strikes chiefly at youngsters—small children and teen-agers—a large number of its victims must be cared for many years, and many carry a burdensome handicap throughout their lives.

During the years 1938–52, 302,677 cases of poliomyelitis were reported in the United States and its Territories. During the same year 20,916 deaths were caused by this disease. The estimate for 1953 is 35,000 cases.

Of the victims of poliomyelitis, 50 percent recover completely; 30 percent have no disabling aftereffects, 14 percent are severely paralyzed, and 6 percent may die.

According to a United States Public Health Service report, more children died in 1952 from poliomyelitis than from any other reportable communicable disease.

According to the World Health Organization, the relatively low incidence of paralytic poliomyelitis compared to many other infectious diseases is counterbalanced by the permanence of the resulting disability, since treatment, prolonged and expensive as it is, is only a palliative; a nerve cell, once irreparably damaged cannot be replaced.

The National Foundation for Infantile Paralysis from 1938 through 1952 spent $145 million for patient care. By the end of 1953 it is estimated that more than 258,000 patients will have received direct financial assistance, in whole or in part, from the National Foundation for Infantile Paralysis. In 1952 alone the patient-care program expenditures were $24,910,000 for aid to 80,000 poliomyelitis patients, more than half of theim victims of previous years.

I think that it is important to note that the problem of the National Foundation and the patient-care program has been the cumulative caseload that has come from previous epidemic years. Even in 1952, with 57,000 reported cases, there was not only the problem of that year alone, but the cases that had occurred in previous years.

The average cost of inpatient hospital care for polio patients (per patient day in all general and special short-term hospitals) during the first 7 months of 1953 was $14. The daily average cost of care of a patient in an iron lung is approximately $19. Service to respirator patients can cost as high as $10,000 to $12,000 a year for a seriously involved case. There are more than 1,500 patients today in iron lungs for all or part of each day. (Source: Statement of Dr. Hart E. Van Riper, National Foundation for Infantile Paralysis.)

CHAPTER II

THE RESEARCH ATTACK

The most promising weapon now available for attack upon disease is a national medical research program that will progressively produce means of treatment and ultimately determine causes and open the way to prevention and cure.

A. POSTWAR EXPANSION OF MEDICAL RESEARCH

There has been a most encouraging increase in the total medical-research effort of the Nation since 1945.

In every disease covered by the health inquiry, witnesses commented upon the extension of research in the laboratory and in the clinic. As a concrete example of this expansion, 18 major voluntary health associations collected $1.5 million for research in 1945. They collected $12.9 million for research in 1952.

In three specific fields, the picture was stated as follows:

Arthritis

Modern history of the national attack on arthritis and rheumatism begins in 1948 with the establishment of the Arthritis and Rheumatism Foundation, organized on a national basis by outstanding rheumatologists and interested citizens. Fund raising for research, treatment, and education in rheumatic disease was initiated first on a nationwide scale in 1948. The public interest aroused by the campaign, although something less than phenomenal, was encouraging. (Source: A joint statement by the National Institute of Arthritis and Metabolic Diseases and The Arthritis and Rheumatism Foundation, pt. 2, p. 438.)

Heart disease

The 5-year record of research awards in both the joint national program and the separate local research programs of the affiliates is shown below. These figures represent the formative years of the American Heart Association as a voluntary health agency during which only limited funds have been available. Since the association began its national research support program in 1949, progressively higher sums have been allotted, making a total of almost $6½ million. Between 1949 and 1953 the number of fellowships awarded grew from 26 to 53 and the number of grants-in-aid increased from 19 to 70. (Source: Statement of the American Heart Association, pt. 1, p. 91.)

Neurology

That both the medical and medical research attack on the neurological disorders is gaining strength there can be no doubt. The past decade has seen a stirring of public and professional interest in this field and the establishment of the various voluntary health agencies, the development and growth of various professional groups and finally the creation of the National Institute of Neurological Diseases and Blindness by act of Congress in 1950 is testimony to the recognition of the neurological and sensory disorders as a major public-health problem. No social or economic history written from this time on can fail to see that the 1940's and 1950's were the beginning of a new medical era. (Source: Statement of October 7, 1953, by the National Committee for Research Into Neurological Disorders, pt. 4, p. 978.)

Despite this increase, in no field of research are funds adequate to permit investigators to follow all of the leads which they feel warrant immediate study.

When scientists interested in specific diseases point out needs for additional research, they almost invariably speak not only of problems specifically related to a disease, but also of basic problems common to many disease areas.

Increasing the number of competent scientists, looking both toward the near and the more remote future, is a matter as significant as expanding funds for current research.

Unmet needs for additional research funds were expressed as follows:

Arthritis

The national attack on arthritis and its related rheumatic diseases, fully organized for only 3 years, has brought about tremendous advances in our knowledge of, interest in, and ability to do something about this family of vicious, crippling diseases. * * *

Although in recent years encouraging progress has been made and although the medical profession, the public, and the Federal Government have now joined in a united effort against it; and although the field is broad and new pathways of research which may lead to the ultimate goal have been opened up, the sum total of our present knowledge concerning these diseases and our present ability to ameliorate their terrible effects are not such as to justify any feeling of complacency. On the contrary, we have learned enough to know that we will need more sinews to wage a successful battle.

It remains for us to utilize now the machinery for attack which is available and with continued and augmented support, to broaden the attack and to conduct it with all the intelligence, energy and spirit which we can command, to the end that we may, as soon as possible, forge the tools with which we can bring these ravaging diseases under control; to the day when arthritis and its cousins no longer constitute the most common major affliction of mankind. (Source: A joint statement by the National Institute of Arthritis and Metabolic Diseases and the Arthritis and Rheumatism Foundation, pt. 2, p. 442.)

Heart disease

There are many avenues of research which are open to a large number of exceedingly good workers in the heart reserch field, and I would say that the amount of funds available at the present time are inadequate to assure the necessary continuity and stability which these and new and potentially able scientists need in order to pursue this problem and its most effective end, which would be to learn a great deal more than we presently know about the problem. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York City, pt. 1, p. 11.)

Tuberculosis

The exact mechanism by which the most serious lesion of tuberculosis, the cavity in the lung, is produced, is not yet known. Good leads are at hand, but methods for following them out to the end desired have not yet been developed.

Satisfactory tests are still to be developed for determining when tuberculosis disease in a given case is active or inactive. Decision as to activity or inactivity governs such factors as use of surgery to eradicate persisting lesions, continuation or not of drug therapy, capacity of the patient to work, and determination of degree of disability.

A superior vaccine is much needed. Relatively simple methods of vaccination have been thoroughly explored, with moderately good results. New methods and more complicated technics may yield better vaccinating materials.

Further research is needed on the means by which tuberculosis spreads from man to man, i. e., on favorable and unfavorable environments for contagion, and particularly on methods for protection against transmission of the germs of the disease through the air, which will be as effective as modern methods for prevention of transmission of diseases through water.

These are only a few of the unsolved problems. Funds in sufficient amount are not available, nor are adequate facilities at hand in many institutions which have capable personnel. The number of well-qualified investigators is small. Funds are needed both for attack on pressing problems by the most modern methods, and for the training of qualified young men and women who can be interested in the study and control of tuberculosis in the future. (Source: Statement by the National Tuberculosis Association, pt. 2, p. 557.)

Neurological disorders

The research effort which should be devoted to these and other promising lines of investigation is, however, at a minimum. Many areas of research, moreover, must be opened up to investigation which have never been brought under attack before. In the many links of fact which constitute our understanding of the functions of the nervous system there are now many gaps to be filled. Important as cerebral vascular disease is to the Nation, the Public Health Service, which supports about one-third of all medical research, is devoting approximately $110,000 to support of investigations in this field. The Multiple Sclerosis Society alone, for example, lists 28 major problems which should be followed up or initiated, each of which should be the object of several different studies.

In many areas, even exploration of the obvious has been neglected and useful results have been postponed indefinitely. There is good reason to believe, for example, that cataracts may occur as a result of changes in the composition of the eye due partially or wholly to the growth and aging process. We have believed this for some time, but in spite of this fact no specific investigation of this problem has yet been initiated—though it is now being planned at the National Institute of Neurological Diseases and Blindness. (Source: Statement prepared October 7, 1953, by the National Committee for Research Into Neurological Disorders, pt. 4, p. 980.)

Mental health

The research carried on today in mental health is extremely important, but is in no way a source of pride when one considers the immensity of the field and how much research should be going on. (Source: Statement by George S. Stevenson, M.D., the National Association for Mental Health, New York, pt. 4, p. 1068.)

In a major 2-year study of training and research just completed by the Council of State Governments, a poll of over 300 research workers throughout the 48 States revealed that the greatest obstacles to research are lack of money and lack of personnel who, after all, cannot be trained without money. This judgment was overwhelming. Three-fourths of these research workers stated that if they had adequate money and personnel they would be able to conduct many research projects of scientific consequence. (Source: Statement of Charles Schlaifer, cochairman, National Mental Health Committee, New York City, pt. 4, p. 1050.)

Blindness

The explanation for the paucity of research effort aimed at preventing blindness is primarily lack of financial support. There are in the United States only 4 or 5 laboratories (Harvard, Columbia, Johns Hopkins, the University of Iowa, and the University of California) which have sufficient funds to employ a full-time research investigator or staff in ophthalmology. Rising costs and the general tendency of private foundations to curtail grants-in-aid have reduced the personnel even in these laboratories. (Source: Statement submitted by V. Everett Kinsey, Ph. D., pt. 4, p. 1022.)

B. MEDICAL RESEARCH HAS PRODUCED RESULTS

Substantial progress is being made in dealing with specific diseases considered incurable a few years ago.

Many witnesses stressed the point that a great deal can be done to relieve suffering and save lives long before the basic causes of all forms of chronic disease are known. On the other hand, wide and important gaps in knowledge—particularly information on the ultimate cause of a number of diseases—were explicitly pointed out. Research on basic causes of disease is progressing on a wider scale than ever before in our history.

Many witnesses were convinced that, although research findings directly applicable to patients may be expected before final answers are found, years of further research are needed before adequate control of many major chronic diseases can be achieved.

Simply increasing the availability of medical care cannot of itself completely solve the problems of disease. One of our prime shortages is that of knowledge: knowledge about the causes of the principal diseases which plague mankind today. Without such knowledge, the prevention, control or cure of many diseases is impossible.

There has been tremendous progress in reducing the death rate from certain diseases, particularly those of infectious nature, with a resulting increase in life expectancy. Infectious disease, for example, has diminished as a national problem because, with identification of the causes of these diseases, it has become possible to develop means of prevention, control, and when the diseases occur, their prompt and adequate treatment.

In the case of noninfectious disease, improvement has not been so marked. There has been an actual increase in the incidence of and death rate from these diseases, especially the chronic, degenerative diseases of an aging population.

Adequate treatment is not now available for such afflictions as heart disease, cancer, arthritis and rheumatic disorders, cerebral palsy and muscular dystrophy. For example, the physician knows that after an attack of coronary thrombosis or a cerebral hemorrhage he can aid the patient by treating symptoms, but cannot prevent or cure the disorder. He does not fully understand the underlying causes of these ailments and is therefore not able to eliminate them. Similarly, he may completely remove a malignant growth by surgery, or slow its growth by X-ray treatment. But if these treatments are not completely successful, as is too frequently the case, the physician is unable to do much more than to provide palliative treatment. He does not know the cause of tumor growth and is thus unable to truly conquer it.

Our physicians are doing their utmost with the tools at their disposal. More and more tools are being developed. But it is no understatement to say that they do not have the knowledge they require to do a really effective job on the prevention and treatment of many chronic and degenerative diseases.

Witnesses explained progress to date and the remaining gaps in knowledge in these terms:

Rheumatic fever and rheumatic heart disease—Progress but no final answers

We give an individual, who has been identified as having had rheumatic fever or rheumatic heart disease, daily prophylaxis, either the sulfa drugs or penicillin, so that he will continually be protected from these types of infection.

I am quite sure that though these knowledges in prevention are of extreme importance and are very helpful, they are not the full answer that we need. In other words, to take a drug, a preventive drug, continually is quite a difficult problem. It is expensive, also. We yet have not determined how much we are preventing.

"I think the problem is still with us, and it has many complexities, but I think that tremendous progress is being made in this area.

That is true, also, in the rehabilitation of adults who have old rheumatic heart disease. Surgical correction of valve deformities at the present time is an important feature of helping some of the adult individuals with crippling heart disease to reassume reasonably active existence. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York City, pt. 1, p. 12.)

High blood pressure—Progress but no final answers

There is no specific prevention or cure for essential hypertension as yet. Research may in the future bring knowledge of causes. Ultimately, there may

be cures and preventive measures. But even today treatment from various directions is better than a decade ago and is improving as time goes on. Surgery, drugs, psychotherapy, and special diets have all been used with frequently, but not uniformly, encouraging results.

A wide variety of drugs have been used in hypertension, but many have been discarded as experience taught they had no particular lasting effect, or produced accompanying toxic effects. Drug treatment, however, continues to be regarded as one of the most important forms of therapy available at present. There are a number of drugs employed today for certain types of cases which give beneficial results, and these therapeutic agents are being continually improved as more knowledge of the body's chemistry, the action of the drugs, and other factors are learned from research." (Source: Statement prepared October 1, 1953, by National Heart Institute, National Institutes of Health, pt. 1, p. 57.)

Hardening of the arteries—Progress but no final answers

Although there are no tests now generally applicable to screening and early detection of atherosclerosis, studies of serial electrocardiograms, and examination of various blood fractions using the ultracentrifuge, and sometimes employing a newly developed infrared light technique for identifying components, may make it possible in the future to identify the disease in a subclinical stage.

Secondary methods of prevention deal with the complications of atherosclerosis, such as thrombosis and occlusion, cardiac arrhythmias, cardiac enlargement, acute pulmonary edema, and cerebral atherosclerosis. Anticoagulants have been developed which prevent the extension of a thrombus, and investigations on the prophylactic values of these drugs are underway. Already anticoagulant therapy is saving many lives. (Source: Statement prepared October 1, 1953, by National Heart Institute, National Institutes of Health, pt. 1, p. 59.)

Congenital heart disease—Solid progress but more answers needed

Not long ago, heart disease present at birth was considered unpreventable and incurable. Today there is not only some knowledge of and means for prevention, but also the march of progress in surgery is continuing to make possible correction and benefiting of more and more of the various types of defects.

In the light of present knowledge, primary prevention centers on protecting the mother. Research has disclosed evidence that virus infections during pregnancy, particularly German measles, vitamin deficiencies, metabolic and endocrine disturbances, and radiation are possible malformation causes when present during the first 3 months of pregnancy. This suggests, among others, such measures for protecting the mother as avoidance or treatment of viral infections during early pregnancy, good diet with supplementary vitamins, avoidance of excessive radiation, and proper management of metabolic and endocrine disturbances.

The complications of congenital malformations are subacute bacterial endocarditis and cerebral thrombosis. The former can be prevented through the prophylactic use of antibiotics or the sulfonamides prior to and following operative procedures, such as tonsillectomies, dentistry, etc. Cerebral thrombosis can be prevented by preventing dehydration for all cyanotic (blue coloration) patients.

Although no specific screening test for early detection is available, chest X-ray surveys, especially in preschool and school children, can help to detect cases in the subclinical stage—before manifestations become apparent to outward appearance.

Treatment is the area in which much good news is being made daily in hospitals and clinics in many parts of the country. Because of recent advances, surgery can now restore to a normal or nearly normal life many children who would have been marked for invalidism or death had they been born 15 or 20 years ago. At least half of the types of malformations can be surgically benefited, and almost every one of the others may be added to the list in the near future as research goes on. (Source: Statement prepared October 1, 1953, by National Heart Institute, National Institutes of Health, pt. 1, p. 62.)

Poliomyelitis—Encouraging progress but no final answers

Under grants from the national foundation several laboratories are busily engaged in the preparation of possible polio vaccines. Typical of these is the laboratory at the University of Pittsburgh under the direction of Jonas E. Salk, M. D., who was also prominent in the task of identifying the virus types.

Here, as was indicated by his article published in the March 28, 1953, issue of the Journal of the American Medical Association, virus of all three types is being grown in thousands of sealed test tubes nested in slotted drums that revolved slowly in warming ovens. When ready for harvesting, the virus is removed, suspended in a salt solution, and exposed for a time to formalin. This chemical inactivates the virus—that is, makes it incapable of causing disease.

After a series of rigorous tests to assure its safety, the vaccine is then ready for critical tests to determine its ability to stimulate the body to create its own protective antibodies against all three polio viruses.

On the basis of these latest findings, the national foundation is now formulating definitive plans for a scientifically controlled human study to evaluate the effectiveness of the vaccine in protecting children against the naturally occurring disease. This will entail the vaccination of large numbers of children in many communities during a nonepidemic period and observing the degree and extent of protection afforded when polio epidemics next visit their communities.

The outcome of such an evaluation study will determine whether a practical vaccine to prevent polio has been developed and how soon such a vaccine can be ready for general use. It is our hope that such a study can get underway during the early months of 1954. I think none of us believed that Dr. Salk's vaccine, if it is in fact a vaccine, is the final answer to the control of polio. I think there are many who feel that socially if we have some means of controlling this epidemic disease, then by all odds we should push ahead with its investigation. Whether the final answer to the control of polio is an inactivated virus vaccine, or a live vaccine, I think will be solved in the years to come.

In the meantime, if this inactivated virus vaccine can produce protection that will persist for a year, then I think socially, if it is without harm to the individual, we should consider its use.

When one considers a study such as is presently being contemplated, if we can do no more than demonstrate that artificially produced antibodies will protect against the natural infection in man, then I think that a fact has been established of great scientific importance. Establishing that fact and determining how much protection an individual must have to prevent the natural occurrence of the disease, then we have a baseline, and any vaccine that may be developed this year, or within the next 20 years only has to be capable of producing a higher degree of protection; that is, more antibodies persisting over a longer period of time. (Source: Statement of Dr. Hart E. Van Riper, medical director, National Foundation for Infantile Paralysis, pt. 3, pp. 776–777.)

Cancer—Continuing progress but ultimate answers remote

And there are other examples of this extraordinary effective program. We want to do a better job of removing and curing cancer, and that is being done.

Modern procedure has apparently increased the rate of cure of cancer from roughly 15 percent to roughly 50 percent.

In the case of cancer of the breast the figures are roughly from 40 to 50 percent under the best circumstances, and the cure rates for cancer of the stomach, low as they are, are substantially better than they were a decade ago.

Also for cancer of the womb a substantial improvement has been had within the last 10-year period.

So, real advances have been accomplished, and they have been accomplished by the most assiduous and vigorous scientific work. It has often been due to new chemical principles derived from laboratories apparently with no connection to cancer, but brought to application by those who are concerned with cancer in human beings.

As to cancer which has spread out from the seat of origin, we do not have any chemical cure today.

We do have much better means for bringing about relief to many patients with widely disseminated cancer than we had a decade ago. It is possible in the case of cancer of the breast, where the disease has gone far beyond surgical treatment, to bring about resistance to the growth of the cancer for periods of from months to years in from 25 to 40 percent of the instances.

In the case of cancer of the prostate, thanks to the work of the group in Chicago we can bring relief to men who have very advanced conditions, whose limbs have become contracted by the pain, in 80 percent of the cases by the institution of chemical treatments.

Now, this is not a cure, but it is a very welcome surcease to patients for months or years.

In the case of lukemia, cancer of the blood stream, we have also made a contribution. We can now bring relief to a substantial number of patients with these disorders. We can keep them in comparative health and comfort for weeks and months and sometimes for years. (Source: Statement of Dr. Cornelius P. Rhoads, director, Memorial Center for Cancer, New York City, pt. 1, p. 292.)

Arthritis—Progress but no final answers

I have been in this field for at least 12 years, and it does not look nearly as bleak as it did 12 years ago. But, I think the obvious thing is that in the last 5 years cortisone has come along through the work of Dr. Hench, and I think Dr. Hench is the one to say that this is not a cure for the disease. It has given us a tool to study the disease in much more detail than we could have before. In addition to that, it has given us an agent which in many instances provides a great deal of relief and a means by which the patient can return to an active, useful existence. I think that is the most obvious beneficial thing that has happened in the last 5 years.

Then there are two other things which I think should be mentioned on a less dramatic plane: One of them is that we know a great deal more about these diseases than we did even 5 years ago. If you go to a meeting of the American Rheumatism Association at the present time, you will find much less loose talk than you did 5 years ago. We know more about what to expect in this regard and we are not as loose as we were in our thinking before. The third thing is that we have gone very far in our study of the connective tissue. This has been a very dramatic—to me at least—course in this study of this whole problem. We have made great advances in our understanding of this connective tissue which is extremely complex and which is important in this particular field, but I think they may be important in many other fields as well. The impetus in this study of the connective tissue has come from the centers which are dealing with arthritis. (Source: Statement of Dr. Charles Ragan, president, American Rheumatism Association, New York, N. Y., pt. 2, pp. 488–489.)

Tuberculosis—Progress but no final application

Application of the knowledge we now have would eradicate tuberculosis. However, further additions to our knowledge of the medical and social aspects of tuberculosis will, it is hoped, make it possible for all agencies concerned with tuberculosis control to progress even faster toward our goal of eradication.

In recent years the treatment of tuberculosis has been enormously improved by the introduction of new drugs and the use of new principles in thoracic surgery. The three most effective drugs are streptomycin, isoniazid, and para-aminosalicyclic acid. Combinations of these drugs have been found particularly valuable. Surgery of the lung, once a very difficult procedure, has become safe and effective, thanks to improved surgical technique, the availability of the new drugs, and modern anesthesia. The most spectacular advance has been in the excision of diseased tissue. Before the new drugs were available this was a dangerous procedure.

Drug treatment and surgery have been aided by noteworthy laboratory advances. Bacteriological studies, for example, have brought to light the most effective combinations of drugs, and have led to practical methods for preventing the development of resistance to the germs of tuberculosis to the drugs used against them. Physiological studies, in turn, on the working capacity of the lungs, have enabled surgeons to determine safe limits in operating for tuberculosis, and to estimate the degree of functional impairment caused by loss of lung tissue.

Diagnostic aids, including better X-ray equipment and other testing materials, have become available, and the differential diagnosis between tuberculosis and certain similar diseases has been greatly improved. Source: Statement by the National Tuberculosis Association, pt. 2, p. 255.)

Neurological disorders—Progress but many answers are remote

As a result of the work done in the past 10 years, such disorders as Parkinson's disease, myasthemia gravis, and especially epilepsy, can be partially controlled through the use of new drugs. Precision diagnostic instruments, like the electroencephalograph and the electromyograph, operate in the field of neuromuscular disease somewhat like the electrocardiograph operates in heart disease,

and the radioactive tracer technique is also pretty well developed. These all mark advances whose potentialities are far from exhausted.

New improved surgical techniques for operations on certain types of diseases have been developed; new diagnostic techniques and some new treatments resulting from ACTH and cortisone have achieved good results in regard to diseases of the eye. We are beginning to use such precision tools as the electro-microscope, employing the technique of X-ray and also the technique where tiny little microelectrodes can be inserted into the patient and be almost concentrated on a single cell, and the culture of planting nervous tissue outside the body so that these living cells grow and reproduce in a test tube under certain conditions.

All of these techniques are new in this field and they promise great things. Within the past year we have seen injections which promise diagnostic tests in multiple sclerosis.

Then, we have the method for regenerating nerve tissue, and this is important, gentlemen. If a muscle is cut or if a bone is broken, those tissues grow back, but there has been the classic formula and belief in neurology that once nerve tissue—that is, brain tissue or spinal tissue—is cut, that is it; it never regenerates and it never grows back, and leads to a permanent injury. Well, in the field of neurology, to paraphrase the song, we have come up with the idea that "It Just Ain't Necessarily So." We will hear more about that later.

We think that you can, with experimental research techniques, make the brain and the spinal cord, once cut, regenerate and maybe even to function again. These are all of the things which have stimulated our efforts in the last few years. One of our great boosts was the Neurological Institute. The rising tide of public interest in the neurological and sensory disorders was largely responsible for the establishment of the National Institute to work on such diseases and blindness. (Source: Statement of Dr. Cornelius Traeger, Multiple Sclerosis Society, pt. 4, pp. 870–871.)

Blindness—Prevention of one cause of blindness is probable

Recently reported research, and the clinical activity by the Institute of Neurological Diseases and Blindness, provide early optimism that the combination of experimental (animal) research and a nationwide statistical survey may now allow the prevention of retrolental fibroplasia. This new disease of premature babies has, during its short life span of 10 years (from the first identified baby to the present probable understanding of its cause and prevention), blinded probably 4,000 babies. The estimated cost for the inadequate care and education of the blind baby is $100,000 during its lifetime, an estimated public future obligation of $400 million incurred during a brief 10-year duration. Successful research can be done at a cost of 10 cents per blind baby. A research cost of 10 cents to prevent an expenditure of $100,000. Does clinical research pay dividends? (Source: Statement of Dr. Lorand Johnson, professor of ophthalmology, Western Reserve University School of Medicine, pt. 4, p. 994.)

A definite termination for the public health problem represented by the neurological and sensory disorders cannot, of course, be predicted. The growth of interest on the part of the public and the State and Federal Governments has been encouraging and has resulted in extraordinary growth within a very few years. There is considerable evidence, however, that even as we move forward, the problems are even larger than we supposed and that we will not resolve them within the near future unless far stronger effort and support is available. This committee cannot urge the Congress too strongly to reconsider the nature of the problem and to join the private and professional agencies we represent in an all-out attack on the neurological and sensory disorders. (Source: Statement of Dr. Pearce Bailey, director of the National Institute of Neurological Diseases and Blindness, pt. 4, pp. 982–983.)

Diabetes—Basic studies now will pay off later

Basic laboratory research and study of patients have contributed greatly to practical knowledge of diabetes as well as to understanding of the intimate biochemical and physiological details of this complex condition. It is not possible to review these contributions in any detail. Several methods have been developed for the experimental production of diabetes in animals, thereby providing a means of studying a facsimile of the human disease in the laboratory. This has led to better understanding of such things as the metabolism of foodstuffs in diabetes, the relationship of diabetes to other endocrine glands, the chemistry of hormones and tissues involved in diabetes, the role of enzymes in metabolic processes, and so forth. Such basic laboratory studies are important and should be continued,

even though their application to the care of diabetic patients may not be immediately apparent. (Source: Statement of Dr. Randall G. Sprague, president of the American Diabetes Association, pt. 2, p. 529.)

The entire field of medical research—Progress

As far as I am concerned—and this is my personal opinion and not the opinion of the American Medical Association, necessarily—I think that we are doing a grand job in the United States in research and I feel that funds are being made available to our research workers from many, many sources, including the Public Health Service, the various foundations, some from the Government and some from private sources, and it is my opinion, having visited many of these institutions, that money is being very well used and that progress is being made. (Source: Statement of Dr. Edward J. McCormick, president, American Medical Association, pt. 1, p. 47.)

C. MEDICAL RESEARCH IS A COLLABORATIVE EFFORT

Private and Federal support for medical research has expanded simultaneously. Federal aid to medical research has stimulated rather than replaced private support.

The general trend of development has been a rising total dollar volume of support (substantially offset by inflation), with governmental and private sources contributing to the increase.

Within the private areas, the earlier key role of the large endowed foundations has been increasingly assumed by the voluntary health associations as the foundations have moved ahead to pioneer in newer fields. In industry, both research in industrial laboratories and support by industry of research in universities and medical schools has expanded. Some industrial and commercial groups have banded together to form foundations—such as the Life Insurance Medical Research Fund and the Vitamin Foundation—devoted to support of work initiated by scientists in universities and medical schools. These farsighted steps might well be emulated by other industrial groups.

The committee hearings record virtually unanimous satisfaction with the manner in which public and private support for medical research have expanded simultaneously:

In the field of blindness

This summer I delivered a paper at the American Association of Workers for the Blind describing some of the advances that have been made in research in the last 3 years in the provision of funds for research. The distinguished members of our research committee of the national society sponsored a study of research and progress throughout the United States in 1949, just before the Institute was set up. At that time we found a total of $906,000 available in both public and private funds for research in this field. The study was repeated for the year 1952, and for that year we find a total of $1,600,000 available, an increase of about 74 percent over 1949.

The setting up of the new Institute with a very small budget has so far greatly stimulated research in this field. It is a small start, however, compared with the need, and it is also very small with what it costs us for other things. (Source: Statement of Dr. Franklin M. Foote, executive director, National Society for the Prevention of Blindness, pt. 4, p. 1004.)

Organizations interested in this field of blindness try to encourage public education and thus gain financial support to advance programs of research and rehabilitation in these fields. The leadership in this endeavor must come from the Public Health Service. If the Congress is informed as to these matters and supports the Public Health Service, various groups interested in the several branches of the diseases closest to them will do their utmost to help find additional funds and thus supplement the moneys appropriated by Congress to meet this situation.

Having finished my 3-year term on the advisory council of the Neurological Diseases and Blindness Institute under Public Health Service, I can truthfully

say that never in my experience have I worked with a group of men and women of such high purpose, deep sincerity, and outstanding ability as the staff of the Institute. In the accumulated experience and knowledge of the personnel in the seven National Institutes of Health, from Surgeon General Scheele, down there has been built a great and able force who can and will, if adequately supported, carry forward and enlarge the programs of research and rehabilitation in the diseases of mankind. The gateway to public health is through research which has been so ably advanced by the seven Public Health Service Institutes, notwithstanding the inadequate financial support that has been thus far provided. (Source: Statement of J. M. Ulmer, Cleveland, Ohio, pt. 4, pp. 1020–1021.)

In the field of epilepsy

Another point I would like to make is that I have never had it explained to me, but somehow the expenditure of public funds in research and in training is always followed by a greater response from the public itself. This year we were awfully pleased to get some increase in the budget of the National Institute of Neurologoical Disease and Blindness. * * * I can say, at least: "There is a central place where research is going to be conducted. There are going to be more men trained. There is hope for you. There is hope for your little girl that in the next few years we may be able to find something to control her." * * *

Public funds in research and training will promote private funds and will double the value of the Government dollar. (Source: Statement of Mrs. Ruth McCormick Tankersley, president, the National Epilepsy League, pt. 4, p. 895.)

In the field of multiple sclerosis

A query: Does the creation of the National Institute of Neurological Diseases and Blindness and the appropriations for it in any way diminish private effort? Answer: Absolutely no; it only increases it.

The efforts of this society and all of its organizations that go ahead and in a voluntary way try to find results have been multiplied. (Source: Statement of Carl M. Owen, first president, National Multiple Sclerosis Society, pt. 4, p. 947.)

In the total neurological field

In the summer of 1950, under Public Law 692, this Neurological Institute was established. Now, for the first time in the history of our Federal Government, there was a concrete expression of interest on the part of Congress in these mysterious neurological ills, and now they are developing a double attack on the problem with voluntary agencies and the Federal Government through the newly created Institute. They have done a good job—a coordinated job—and the interest of the public has been stimulated in direct ratio to the increased development of the program of the National Institute of Neurological Diseases and Blindness. But all this is not nearly adequate to solve the problems posed by 20 million sufferers. (Source: Statement of Dr. Cornelius Traeger, Multiple Sclerosis Society, pt. 4, p. 871.)

In the financing of cancer laboratory construction

The National Cancer Institute has supported the construction of laboratory facilities to the extent of about $16 million. We have done nothing like that with the American Cancer Society funds as a matter of policy. Here it might be interesting to point out that in regard to the $16 million which is appropriated and now spent for the construction of laboratory facilities in cancer research throughout the country, approximately $100 million was subscribed locally. So, that money is returned about sixfold. It is our belief that both the American Cancer Society and the National Cancer Institute are supported by public funds. Those of the Cancer Society are given under voluntary donation at the time we conduct our crusade in April, and those to the National Cancer Institute through appropriations. (Source: Statement of M. R. Runyon, executive vice president, American Cancer Society, pt. 1, p. 274.)

Collaboration between two new forms of organization for health matters—the private health associations and the National Institutes created by Congress for attack upon disease—is close, continuing, and effective.

These working relationships are so effective as to preclude unproductive duplication and overlapping in the work of the two kinds of

agencies. The mechanics and spirit of collaboration are illustrated by testimony in the cancer and arthritis fields:

In the cancer field

I have participated for the past 3 years on the Advisory Council of the National Cancer Institute. Dr. Cameron, who talked this morning so much to the point on the control part of this program, has served on the control grant study panel, the group which advises the National Advisory Cancer Council on what control grants should be made.

In addition to these more or less formal lines of communication, there is continuous staff attendance at each other's meetings. Representatives of the National Cancer Institute attend research meetings of the American Cancer Society and vice versa. There is joint service between members of our staff and their staff on committees, such as the American Committee for the International Union Against Cancer, and on the Lung Cancer Committee, as well as on the Gastric Cancer Committee. Also, there are frequently many joint project site visits to research institutions in the United States performing similar types of research. (*Source:* Statement of M. R. Runyon, executive vice president, American Cancer Society, pt. 1, p. 274.)

In the arthritis field

When the Institute of Arthritis and Metabolic Diseases was established I was invited to serve on the National Advisory Council of this Institute. Having been in part responsible for the establishment of the Arthritis and Rheumatism Foundation, and being in the private practice of medicine, I had entertained serious misgivings regarding the place of Government in such a field. However, I accepted the appointment and served until its expiration this year. During this period I saw the closest possible cooperation established between the Arthritis and Rheumatism Foundation, the American Reumatism Association, and the Institute of Arthritis and Metabolic Diseases. The grants-in-aid program carried on by the Institute has been the finest and most efficient program carried on it has been my pleasure to see. The major difficulty has been insufficient funds to support worthwhile projects in research. This year's increase in the funds of the Institute will help in a large measure the immediate urgencies. As the program has been administered, there has been ideal relationships between the Institute and the research worker and with the private agencies. The present situation, then, in regard to this topic, is very satisfactory.

Finally, I would like to just close this simple statement by speaking of the effectiveness of current methods of providing Government support to research in these diseases. So far as I am able to see, and I am on the medical and scientific committee of the Arthritis and Rheumatism Foundation and the American Rheumatism Association, and I am well acquainted with the work of the National Institute of Arthritis and Metabolic Diseases, there is no undesirable competition or overlapping in the function of these three important bodies.

By design, a certain amount of overlapping in membership on their controlling committees has been established. Mr. Floyd Odlum, for example, who is chairman of the Arthritis and Rheumatism Foundation, is also a member of the National Advisory Council on Arthritis and Metabolic Diseases of the United States Public Health Service.

Dr. Bunim here, who is in charge of the National Institute's program in arthritis and rheumatism, is also a member of the executive committee of the American Rheumatism Association, and of the medical and scientific committee of the Arthritis and Rheumatism Foundation.

The key people in the several organizations are able to see that undesirable overlapping does not occur, and that there is a coordination of the whole effort, which I must say is most cordial and helpful in every area. I have seen it in operation. (*Source:* Letter dated October 1, 1953, to chairman, House Committee on Interstate and Foreign Commerce, from Dr. Paul Holbrook (Tucson, Ariz.), past president of the American Rheumatism Association and former member of the National Advisory Arthritis and Metabolic Diseases Council, pt. 2, pp. 517–518.)

Multiple sources of support, adequately and properly coordinated through their voluntary actions, as contrasted with a limited number of sources of support, have fundamental advantages.

Apart from the problem of the coordination of the activities of groups supporting research, witnesses spoke of the coordination of the work of individual scientists. The consensus was that direct coordination by governmental or other superagency is not desirable. Rather, there was strong feeling that scientists and physicians are self-coordinated by the very nature and traditions of their work. To attempt overall coordination would, in the minds of scientists who testified, be dangerous. On the other hand, the communication among scientists upon which real scientific coordination depends should be strengthened.

Typical expressions of these viewpoints on coordination among agencies and among scientists follow:

For all fields

I think that there is very grave danger in limiting the number of fund-granting agencies for medical research to any very limited group of human beings or agencies. In other words, the freedom of scientific inquiry is greatly heightened when the authoritative control of the acquisition of knowledge is put in multiple agency or group hands rather than concentrated in a single authority, because no one is divinely ordained in this respect, and unless he were he could not predivine what was coming from any given grant.

I think it has been obvious from this discussion today that there are a number of agencies which are vitally interested in getting increased funds from the private individuals of this country; in getting, if possible, an increased volume of high-quality research; and in insuring that they are and will be spending funds well.

There are also multiple sources within the Government agencies. I am sure not only the Public Health Service, which has been concentrated upon today, but others have some interest in this field. I hope that there will be no grouping of everything under one single pattern of administrative control because when we do that then we obliterate the opportunity for the little-known person, and he may be the man who is going to bring us possible knowledge of great importance for the future. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York City, pt. 1, p. 132.)

For the neurological field

The greatest stimulation to research in this field, as in others, however, has come from the Federal Government, and it is to Washington that we have looked finally for that implementation of the neurological research effort which will supplement on a broad scale the efforts of the voluntary health agencies and individuals working under university or institutional auspices. While it is clear that the Federal Government must bear a large part of the burden of support of research in this field, it should not be wholly in their hands. There are many authoritative differences of opinion of the kinds of research to be undertaken concerning any given problem, and which approach is most valid can only be tested by actual experiment. Diversity of support, therefore, guarantees that many different opinions will prevail and that the research attack will be various enough to increase the chances for success. (Source: Statement prepared October 7, 1953, by the National Committee for Research Into Neurological Disorders, pt. 4, p. 981–982.)

There is no doubt but that the entrance of the Federal Government and of the large private agencies into support of research has influenced the general direction of the Nation's medical research effort in significant respects, and the support of the large private organizations has had a similar effect. The testimony in the cancer, heart, neurology, and arthritis fields, cited above, indicates clearly that more is being done in these fields than would have been true if the support had not been available.

The vital importance of leaving to the collective judgment of scientists decisions as to the most productive lines of attack on dis-

eases—whether to concentrate upon causes or cures, whether to concentrate directly upon problems restricted to a disease or whether to concentrate upon problems of potentially wider significance—was stressed by many witnesses. In addition, every witness who touched upon this topic emphasized that the individual scientist must be free to conduct his work without outside interference. While the need for planned research in some areas was mentioned, witnesses noted that participation in planned research must be left to the free choice of scientists.

To assure such freedom of choice, it is necessary that there be adequate support for noncategorical as well as for specific disease research. From the testimony it is evident that the provision of funds for research by public and private organizations has given adequate latitude to scientists and has permitted them to apply their brains to areas of research which are in their judgment best designed to produce the ultimate answers.

It seems evident from testimony dealing with the nature of research in progress that the increase in the volume of research funds has enlarged the effective area of freedom through making possible a broad research attack of the kind dictated by the combined medical-research brains of the Nation. When these questions were discussed by witnesses, they reported positively that they were pleased with the general quality of administration and with the absence of bureaucratic interference with work supported by these sources.

In the field of blindness

As professor of ophthalmology and as a practicing opthalmologist—and I believe I speak for the societies that represent the blind—our confidence must remain in Congress to appropriate adequate sums, and we certainly have the utmost confidence in our Institute of Neurological Diseases and Blindness to administer these funds properly. (Source: Statement of Dr. Lorand Johnson, professor of ophthalmology, Western Reserve University school of medicine, pt. 4, p. 1018.)

In the arthritis field

As the dean of a medical school I have profound admiration, sir, for the way in which the United States Public Health Service has handled its important work in the research field. I know of no grants that we in the medical schools or research institutions throughout the country can handle with greater academic freedom—freedom from constrictive redtape—than those which are granted to us through the United States Public Health Service through the various national institutes.

Whatever the feelings of the profession, or various segments of the profession, has been on the score of governmental participation in medical practice—and that is practically universal—and whatever the feeling may be about the doubts that some medical educators have concerning the wisdom of governmental grants-in-aid of medical education, I have never or almost never heard any question at all raised about the Government grants-in-aid for research. I think one of the reasons is that it got started early, and it has been so splendidly administered that there could not be any criticism of it. The criticism got nipped before it ever could have started. It has been well done. (Source: State of Dr. Currier McEwen, past president, American Rheumatism Foundation, and dean, New York University college of medicine, pt. 2, pp. 455 and 448.)

In the mental health field

The Federal money which has been coming to medical schools has come to them with no strings attached to it, and it has been accepted very gladly by the deans and has been utilized to the very best of their ability. (Source: Statement of Dr. Francis J. Braceland, psychiatrist in chief, Institute of Living, Hartford, Conn., pt. 4, p. 1128.)

In the cancer field

We have had from the National Institutes of Health in the various areas very important subsidies, both at the teaching level and at the research level. Having been honored with the service as chairman of the anatomological study section, when it was carried on under Dr. Dyer some 7 years ago and for 5 years having served on that from the standpoint of the requests coming in for worthy research projects, I certainly want to testify to the extreme value that it has been to us, both from the standpoint of the receiving end and from the standpoint of the gram gives us the kind of unity which is really going to bring answers to these funds. I want to say that I think it is a most magnificent program. This program gives us the kind of unity which is realy going to bring answers to these questions. (Source: Statement of Dr. Charles Doan, dean, college of medicine, Ohio State University, Columbus, Ohio, pt. 1, p. 423.)

The States might well assume broader medical research responsibilities

The role of States in the health field, as was pointed out above, has been primarily in protection of public health and provision of medical care—particularly to tuberculosis and mentally ill patients. Indirectly, States finance medical research through their general appropriations to State universities and medical schools. Directly, the public-health laboratories of a few States conduct medically related research, but the great bulk of the work of these laboratories relates to diagnostic and other tests.

The testimony suggests that States might logically undertake wider responsibilities for research, in view of their enormous financial stake in the reduction of the prevalence of certain diseases (most evident in, but by no means confined to, mental health and tuberculosis). The Council of State Governments has made a concrete proposal for expansion of research on mental illness by States, "Training and Research in State Mental Health Programs—Summary and Recommendations" (p. 129 of the health inquiry). This realistic and practical document might serve as the prototype for inquires into research related to other diseases of interest to the States.

There is no practical alternative in the foreseeable future to substantial Federal support for medical research in the universities, medical schools, hospitals, and other private laboratories of the Nation. This viewpoint was not, however, unanimous since one witness expressed the wish that all medical research could be supported by means other than Federal appropriations:

I have not any idea how much money is being collected for medical research at the present time. I understand that it is a rather sizable fund, and I think probably the men here at the table will be able to answer that better than I can.

I would say this, however, that fundamentally I believe that it would be best if all of this work could be done on a voluntary basis without too much Government help.

In other words, I think we are doing a pretty good job in most fields of research at the present time. I think the Government is doing a good job, but I do not think the Government ought to go overboard on it. I think it ought to be left so far as possible to the voluntary American way of doing it. (Source: Statement of Dr. Edward J. McCormick, Toledo, Ohio, president, American Medical Association (Hon. Morgan M. Moulder is member of Committee on Interstate and Foreign Commerce), pt. 1, p. 48.)

As a general consensus, however, it was apparent that in disease areas stimulated by the recent creation of National Institutes—most notably neurology and arthritis—particularly heavy dependence is being placed by the scientific community and by voluntary organizations upon the activities of the Federal Government to share—and in some cases lead—expansion of work, and to symbolize on the national scene the significance of the diseases with which they deal.

Witnesses expressed these opinions:

In all fields

Could I address myself to one remark that was asked of Dr. McCormick, and that is the question of the public moneys being used, to just say that if it had not been for the National Institutes of Health research programs of the past few years, it seems particularly certain that medical science and work going on in voluntary and State institutions throughout the country indeed would have been very heavily handicapped. The method of administration of these grants is a technique which is known very little to the public and is probably one of the most extraordinarily successful ways in which public funds can be utilized with about as complete freedom as is possible. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York, pt. 1, p. 49.)

In the field of neurology

Research devoted to the prevention and cure of these neurological disorders must have a high priority. Within the past 2 or 3 years there has been more active recognition of this fact by voluntary health groups and the professional persons or groups associated with them, and more funds have been devoted to research than ever before. But the burden of maintaining adequate health services and facilities, plus the tremendous research needs in the field makes the total support of research by private sources an obvious impossibility. (Source: Statement prepared October 7, 1953, by the National Committee for Research Into Neurological Disorders, pt. 4, pp. 981–982.)

In the field of blindness

Gentlemen, it is virtually impossible for me to convey to you fully the many hardships and difficulties encountered by a voluntary agency committed to the pursuit of gathering funds for research to prevent blindness * * * I feel confident that with unyielding perseverance, in time public recognition and support of this important branch of medical research will come. However, we must not wait for this public recognition; we cannot and dare not in view of the distressing facts and overwhelming need. Gentlemen, I cannot stress too strongly the inability of the voluntary agency at this stage to shoulder this grave responsibility singlehandedly.

I have had occasion recently to meet with the distinguished members of our scientific advisory board and can attest to their strong belief in the great potential that research holds for finding the solutions to the problems now producing blindness. I welcome this occasion to tell you of the enormous value they place on the contribution the National Institute of Neurological Diseases and Blindness has already made in stimulating research activity in this area of medical research by the financial assistance it has given to date. It is imperative that such support not be withdrawn. It must instead be increased. The research activity which it has inspired should not be inhibited. It must rather be encouraged, and extended. (Source: Statement of Miss Mildred Weisenfeld, executive director of the National Council to Combat Blindness, New York City, pt. 4, p. 1010.)

D. DIVERSITY AND FLEXIBILITY IN RESEARCH

Just as witnesses stressed the importance of diversity in sources of support for research, they emphasized the essentiality of a diversified scientific approach to medical research. There was general recognition of the need to support research on a scale that will permit work both in the laboratory and in the clinic, with freedom to shift emphasis as the needs of science indicate at any stage of research or for any disease.

It is also evident from the testimony that the most effective research attack is by a broad spectrum of research expanded across the board ranging from basic studies to research directly and currently applicable to more effective treatment of disease.

There was wide agreement that the whole area of medical research would benefit by more intensive effort to uncover the ultimate physiological processes that explain health and disease.

Witnesses noted that such studies often appear abstract and unrelated to disease problems when taken out of the context of the interlaced research approach of which they are an integral part. These investigations are, however, on the frontier of medical research.

In the opinion of many witnesses, not only must the volume of work in this noncategorical and basic area be adequately supported, but expansion of such studies is a matter of high priority.

The reason for this belief is the fact that disease is an abnormal functioning of one or more parts of the machinery which makes up the human body. To understand the abnormality and its causes, it is necessary to know and understand the normal processes and functions. Thus, one of the primary objectives of medical research must be the attainment of knowledge which permits a fuller understanding of the fundamental life processes that make the body function as an organized and well regulated machine.

Lying behind such studies related to disease is yet another area of study of fundamental importance not only to medical but to all research. Advances in research relating to medicine will be retarded and will ultimately cease unless our knowledge of the ultimate nature of the physical universe expands. The thermodynamics of chemical reactions, the electrical properties of solutions, sols, gels and membranes, the basic character and methods of formation and breakdown of large molecules, the mathematical techniques by which these phenomena are reduced to quantities—all of these must be intensively investigated so that the findings can be applied to research bearing upon disease.

Since the witnesses were concerned with medical research, there was little direct and explicit reference to the critical importance to medical and to all science of expansion of fundamental studies entirely unrelated at this time to disease problems. Yet the general logic of the testimony of a large number of research experts, and a number of specific lines of testimony, amply demonstrated the concern of the medically oriented people for the maintenance of the source knowledge upon which they acknowledge ultimate dependence.

A set of comments of the sort leading to these generalizations is reproduced below.

In the cancer field

In the field of cancer no valid distinction can be drawn between pure and applied research. The investigator in the basic sciences is constantly developing new ideas, devising new tools, and exploring new methods of approach which he refines and passes on to the clinical investigator. The latter, as constantly, is redefining problems, passing back new leads, testing out ideas at the clinical level, and thereby channeling the effort of the random investigator. The direct and oblique approaches are not so much competitive as complementary. The issue is not between alternative strategies. If you are faced by a stubborn enemy, a frontal assault is strengthened, not weakened, by a simultaneous and sustained attack upon his lines of communication and his source of supply. Concentration of effort is good strategy when you are still feeling him out, still seeking out his main line of defense. In this situation pressure must be maintained on all fronts. One must probe continually anywhere and everywhere looking for the weak spots. The war on cancer is still a war of maneuver. The enemy is not yet pinned down. We are not yet in position for the grand assault. We are not yet sure what types of weapons will be most effective in subduing him.

(Source: Statement of Dr. Charles Cameron, medical and scientific director, American Cancer Society. Pt. 1, p. 181.)

In the arthritis field

The need for new knowledge in the medical sciences is most pressing. We need to know more about the structure, composition, and functions of human and animal tissues, especially connective tissue. This calls for scientists skilled in biology, biophysics, biochemistry (especially enzyme chemistry), endocrinology, and clinical medicine.

It should be emphasized that it is essential that scientists drawn from these disciplines must work closely with the clinical investigators who have firsthand familiarity with the gaps in our knowledge. The direction, the goals, the needs must be defined by the physician who faces the responsibility of controlling these recalcitrant diseases. On the other hand, the exploration of the unknown, the discovery of enzyme systems involved in mechanism of certain diseases, the development of new and precise analytical, chemical, and physical methods, the exact nature of hormonal imbalance must be worked out in the laboratory. But always there must be the closest possible integration of efforts and interchange of ideas between the clinician and the laboratory worker. (Source: Statement of Dr. Currier McEwen, past president, American Rheumatism Association, and dean of New York University College of Medicine. Pt. 2, p. 441.)

In the field of poliomyelitis

I would like to begin by saying that research on the control and prevention or conquest of a specific disease is a little bit different from scientific research in general. It has a great deal in common with the process of development which occurs in industry where the product of scientific research in general, the knowledge so gained, is used to achieve a specific objective. In other words, you may have all the scientific progress made in a field in general, but to bring all that progress or knowledge to bear to achieve a specific objective requires a different type of organization.

I think this has a specific bearing on poliomyelitis. I think the utilization of accumulating knowledge on poliomyelitis is a special problem which cannot be left to the whim and fancy of an individual engaged in scientific research. As a matter of fact, I think in general the higher the caliber of the imagination and initiative of the individual, the less he is inclined to put those last, finishing touches on, that will transform knowledge not yet applicable to that which is applicable.

I believe a certain amount of direction for research in poliomyelitis is needed, and information accumulated, particularly in the last 3 years, makes it a particularly burning issue at this time. I would think one of the ways to achieve this particular objective is to go out and recruit people to do certain work, set up the general objectives without telling them precisely what to do, and getting them to do the work and acquiring the facilities for achieving that. (Source: Statement of Dr. Albert Sabin, Children's Hospital Research Foundation, Cincinnati, Ohio. Pt. 3, p. 862.)

In the field of epilepsy

What is the story about the research being done in this field of epilepsy?

There is at the present time a group of investigators who are ferreting into the problems of the underlying chemistry of the brain and the underlying chemistry that produces the electrical discharge. That is one type of investigation.

Another group of investigations is concerned with the process of hunting for that particular spot, somewhere dead center, we could say, which can fire out to all the rest of the brain and throw the entire brain into convulsive activity.

Now, the other investigative work that is going on, or some of it, is a bit pedestrian, that most of us are doing in the clinics, in trying new drugs and critically trying to assay them.

On this business of treatment, the real hitting at the problem is by those people who are trying to tag the carbon molecule of phenobarbital with an atom and trace it and find out where it goes.

That is also true of all those people studying the enzyme chemistry of the drug and the effect on the brain. By that type of approach we think we may be able to come far closer in shorter order than by merely using the trial-and-error method most of us are using. (Source: Statement of Dr. F. M. Forster, professor of neurology and dean of Georgetown University Medical School. Pt. 4, p. 888.)

In the heart field

However, there is one great disseminating lack in our total situation now, and I hesitate to mention it because I do not think basic research from a scientific point of view is adequately being supported today in relation to what its opportunities are and what its needs are. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York. Pt. 1, p. 21.)

One of the points that I think ought to be emphasized in an introductory way is that we speak continuously of basic research and yet, being practicing medical men, we have to deal with the practical aspects of doing the best for the patients at the time that we can with what we have available. This has two effects so far as research is concerned. It makes us emphasize the practical or treatment aspects of the disease. That is particularly pertinent to hypertension, when we do not know its cause and we are really groping in the dark as to the proper methods of treatment.

I would say that that feeling has dominated the research that has been done in the hypertension field in the last several years. I, myself, have been active in it and guilty of it; namely, that we felt that treatment was so urgently needed that we have devoted a great deal of time to treatment and as a consequence we have perhaps left undone some of the basic research that could be done and needs to be done as to cause or mechanisms, if you will. (Source: Statement of Dr. Robert W. Wilkins, vice president of the American Heart Association, Massachusetts Memorial Hospital, Boston. Pt. 1, p. 129.)

E. THE CRITICAL PROBLEMS OF MEDICAL RESEARCH

A line of testimony developed emphatically by a number of witnesses dealt with the threat to the future of medical research arising out of inadequate attention to the training of manpower for the years ahead.

Support of medical research cannot be divorced from research manpower and from the strength of the institutions which train research manpower. It is manifest that concentration upon support of current research—necessary and valuable as it is—has been accompanied by inadequate attention to all of the factors entering into the production and maintenance of a larger national pool of highly qualified medical research scientists.

Steps to resolve these problems are clearly the most urgently needed action in the whole field of medical research in order to give the Nation a more adequately balanced total medical research program.

Problems seen from the viewpoint of heart research

Dr. WILKINS. Where are you going to get the people and where can you train them? This hits into the hard fact, so far as I am concerned, of the needs of medical education.

I do not want to deviate from my subject except to insert for the record, Mr. Chairman, that medical education today, in my opinion, is in a crisis situation and that something has got to be done or the recruits from which we in the research field hope to draw new material in terms of young, bright minds equipped by training to do the work that needs to be done will not be available to us in the proper quantities.

Dr. WRIGHT. Dr. Wilkins, I am sorry to interrupt; but please illuminate the committee on why you consider medical education to be in a critical state at this moment.

Dr. WILKINS. Well, I consider it to be in a critical state because of the medical schools, all private medical schools—that is, those not supported by State governments—being financially badly in the red and having been so for a number of years. They are losing propositions.

In my own university the medical schools spend far and away more money than any other department of the university and does not even pretend to meet from its tuition income the costs of medical education; and the university has told us frankly that this can go on for a few years, but it certainly cannot go on

indefinitely. That is just one medical school, but I know it is not unique. It is country-wide.

Where you have State or Government support of some kind that situation is not as critical.

Now, speaking for my own school, we would like very much to expand our school for the public good, to educate mor doctors, to educate more research workers, and to get more people to draw on. We cannot do this under the financial situation in which we now exist * * *.

I do not know what the solution to this is, but if medical research is going to continue as it has in the past to be centered largely—I am not saying totally or that it should be totally—around medical schools, schools of medical education, then I believe our most crying need is to do something to relieve the medical schools and to get them on a sound economic and businesslike operating budget and something that will pay its way at least as it goes. (*Source*: Statement of Dr. Robert W. Wilkins, vice president of the American Heart Association, Massachusetts Memorial Hospital. Dr. Irving S. Wright is past president of the American Heart Association and professor of clinical medicine, Cornell University Medical School. Pt. 1, pp. 130, 131.)

From the vantage point of an expert in arthritis and medical school dean

More medical students are now receiving more and better instructions in arthritis and the rheumatic diseases from instructors who are better prepared and more interested in the problem than they were in 1948, but still the problem of scientific and medical manpower in this field is urgent. Teaching grants, research fellowships and research grants are the answer.

Because for years there was little that medicine could actually do even to relieve, let alone cure, those who suffered from rheumatic diseases, both the medical profession and the public came to regard them as something you sort of "had to learn to live with." This apathy still persists, although to a more limited degree. It is difficult, in many quarters yet, to arouse interest in the problem. Medical schools still do not provide adequate instruction in the rheumatic diseases to either undergraduate or postgraduate students. Curricula are already crowded with other subjects. The schools lack adequate instructors, adequate space for research laboratories, clinical investigations and training, and specialized training must be provided. This can be done by making teaching grants to medical schools.

The CHAIRMAN. Do you have in mind any program of a legislative character, acting through Government agencies, which could improve the situation with respect to the number of specialists or a more general diffusing of knowledge among practitioners, or through the use of clinics, which would improve this situation?

Dr. MCEWEN. I am not sure whether this comes under the heading of legislative need or not, Mr. Wolverton, but the thing that occurs to me is this: From where I sit as the dean of a medical school facing this problem, which to me is the basic one, the bottleneck today in our whole program of training more physicians who will be interested in these diseases and hence go on to research in them, is in teaching grants and construction grants. To me the great needs are for teaching grants and for construction grants. I will put them in that order.

In the case of teaching and in the case of construction the fact of the matter is that there are only in this country today a handful, perhaps half a dozen, medical schools where they have full-time men on their regular staff devoting their attention to the rheumatic diseases. Now, there are many, many medical schools—practically all medical schools in the country—which have some splendid and devoted part-time men who make their living in practice and devote some time each day to the hospital and teaching work, who are expert in rheumatic diseases. But, important as they are, the whole trend of modern medical education is that the person who makes the impact on the young student is the full-time man who is with him all day long, the same way that the man who attracts the research grants is the full-time man. How often does a foundation or the United States Public Health Service entrust to an individual in private practice, let us say, a large sum for research? It is not often. There are brilliant exceptions, where magnificent use is made of this, but by and large they do not have the time for this sort of thing that the full-time man has.

Be that as it may, the fact remains that the impact on the student is made by the full-time man.

Mr. HESELTON. Of course, I can appreciate that. On the other hand, if you set up research projects and set up scholarships and fellowships, and you do not have the facilities to put these people into, it seems to me you are running up against a dilemma * * *.

I must confess I do not know whether you should keep your building program up or whether you should keep your fellowships or scholarship program up or your research activity up, if you have to sacrifice in some other field.

Dr. MCEWEN. If I could answer that, Mr. Chairman, I think it is in some sense like deciding which one of the wheels of an automobile you are going to leave off * * *. Certainly, the needs in research are tremendous, speaking as I did a while ago, especially to the point of medical teaching and construction grants.

I, nevertheless, emphasize—I hope properly—the fact that even today, and although there is no doubt about the fact there is a shortage of trained people to work in this field, even today the National Institute of Arthritis and Metabolic Diseases receives applications for more worthwhile projects then they can use their present research funds to take care of. So, it would be disastrous, I think, to back up on the research grant side, and yet, at the same time, if we are going to get away from those areas like the Northeast and a few other places where they are now looking to do research in these fields and have it spread out throughout the country, then, we have got to add teaching and construction grants to bring it about.

Mr. HESELTON. I notice on this particular sheet that it is stated that the request in the amount of $19,584,100 is for the construction of research facilities, and such request has been received from 86 leading institutions throughout the United States, which indicates that there is a very healthy desire to extend this work. We do not want to take anything away from the rest of those which are worthy projects, and far be it from me to do that. (Source: Dr. Currier McEwen, past president, American Rheumatism Association, and dean of New York University College of Medicine, and Hon. John W. Heselton, Committee on Interstate and Foreign Commerce of the House of Representatives, pt. 2, pp. 440, 442, 457, 492 and 493.)

From the viewpoint of a neurologist and a medical school dean

The matter of the medical schools was brought up several times. Speaking now as a dean, I think I might be able to give you some information you may like to know.

Obviously you wonder why the universities, which we have long looked to as the citadels in knowledge, are not forthcoming in backing research. This is not only true for this institute but for all institutes.

I would like, in case you are now aware of the plight of the medical schools, to say that at the present time the tuition range in medical schools in most areas is somewhere in the neighborhood of $900 per year per student, which we think is terrific, really, but the cost of educating that student in the medical school averages, across the country, around $3,300 per year. Therefore, we in the medical schools are operating at a loss.

The private philanthropic funds are no longer available, or to a very limited degree, so that the medical schools have that particular plight.

Actually, I happen to be more fortunate than most of my colleagues because the rector of our university understands what we are doing. For most of the deans of medical schools one of the chief jobs is to sell the president of the university the idea of not letting go of the medical school, because they look at it as the hole in the bucket of the finances of the university, and they feel that the medical school is siphoning out the funds of the whole university * * *.

Sir, I think that is the situation in the medical schools. (Source: Statement of Dr. F. M. Forster, professor of neurology and dean of Georgetown University Medical School, pt. 4, p. 889.)

An adequate number of well-trained scientists is the most important single factor in determining whether or not progress is made over the years to come in the fight against disease. Money and facilities are needed urgently, but they will not of themselves produce the knowledge we need so urgently. The crucial factor is the intelligence of adequately trained, dedicated men and women who will, if given the opportunity, explore new avenues of science and thus bring us to our desired goal.

While the existing corps of competent investigators can productively use additional funds, as shown above, many witnesses of the highest repute warned that for the future expansion of the Nation's supply of medical research manpower is a matter of utmost urgency.

This manpower is, broadly speaking, of two types: (*a*) The men and women trained to the doctor of philosophy level and beyond in various scientific fields, and (*b*) the small proportion of medical students who, after receiving the doctor of medicine degree, go on to take postgraduate training which equips them for research work. The former group, by far the larger, consists of biologists, biochemists, physiologists, psychologists, biophysicists and many others whose postgraduate training equips them specifically for research activity. The record of the hearings is studied with references to the expanding and vital importance of these scientists to medical research.

The research physician, a smaller proportion of the total, is indispensable since without him research involving patients is impossible. Witnesses noted the particularly extensive training required of highly trained research physicians. After receiving the doctor of medicine degree, these people must typically undergo additional years of training to prepare them for research. Most of these physician-scientists are on the full-time staffs of medical schools.

Inability of medical schools to finance an adequate number of full-time senior faculty positions, particularly for research, is a major deficiency in the medical research structure of the Nation.

A grave problem related to the recruitment of research investigators is that of affording reasonable assurance that stable, secure, and materially rewarding job opportunities will be available. Research in the medical and related sciences, as distinct from the practice of medicine, is a low-paid profession. Moreover, the income of many investigators is not only low, but uncertain. Each year an increasing proportion of our research investigators is dependent on short-term grants or contracts not only for the costs of their research but for their very livelihood. Many such individuals do not know from year to year whether or not they will be able to continue their work during the following year since their salaries, their research, their very careers depend on renewal of grants or contracts. A demanding profession requiring long years of training that offers low salaries and lack of security and tenure, is not an attractive prospect to a young man seeking a career. The fact that many brilliant young men or women choose a scientific career, at low salary and frequently on a temporary and insecure basis, is a tribute to their courage and devotion to a way of life. It is almost certain that unless something is done to remedy this serious problem, there will develop a shortage of research scientists just as there has developed a nationwide shortage of teachers and nurses.

Mechanisms for solving this crucial bottleneck are being evolved. For example, in its testimony (pp. 50 and 110) the American Heart Association reported on the establishment of a program of career investigatorships:

> The research ideal of the association is best demonstrated by the career investigatorship, created in 1951 as the first research position of its kind established in the voluntary health field for the encouragement of unrestricted, lifetime medical research. The career investigator receives an annual grant from the association throughout his productive career.

The first recipient of this new type of award, Dr. Victor Lorber, has transferred his research activities from Western Reserve University Medical School to the University of Minnesota. Dr. Lorber is engaged in a study of chemical processes within the heart muscle. As funds permit, it is planned to create additional career investigatorships in the cardiovascular field. (Source: Included in report of American Heart Association for 1952, cited in the hearings, pt. 1, pp. 110–111.)

This corresponds to the establishment or endowment of a professorship except that the individual may work at any recognized institution. The program, inaugurated in 1951, has now grown to the point where three career investigators are being maintained by the association. The cost per year of these career investigatorships is $25,000 each, including the salary and funds for technical assistance, supplies, and institutional overhead. Over a period of 10 years, this means the obligation of $250,000 per career investigatorship.

Considerable sums of money would be required to expand this type of support. The magnitude of the sums that would be required to affect materially the existing dangerous situation that now exists may well require Federal participation to supplement the pioneering but limited private efforts. An immediate and practical step forward is to make available to appropriate Federal agencies funds adequate to establish supplemental forms of support, such as long-term career investigatorships, or appropriate modifications of this principle.

Another facet of the manpower problem is one of recruitment—of inducing a larger proportion of our most intelligent young people to enter the medical research field. Although the private and governmental agencies supporting research are providing fellowships to draw highly qualified people into medical research, more of these fellowships are needed for people in training for the doctoral degree, and for the more advanced training of those with the degree.

From the viewpoint of a committee member

Mr. PRIEST. Dr. McEwen, in view of the situation which you have described as a teaching bottleneck, I wonder if the funds appropriated by the Congress to the National Institute of Arthritis and Metabolic Diseases are sufficient? I wonder, if we were able to obtain rather considerably larger appropriation, if they could be fully utilized under the grant-in-aid system, unless we remove the teaching bottleneck existing? I should like to have an expression from you on that rather broad question.

Dr. MCEWEN. Mr. Priest, that is a question which those of us working in the scientific and professional end of these diseases have scratched our heads over many a time. I think that the obvious answer to it is that there is an enormous need for more research and more funds for training men. Until a greater interest—and it is growing all the time now—among the medical students of the country comes into being, there is competition for these well-qualified men. There is competition among those of us interested in arthritis, heart disease, cancer, polio, or whatever it may be, for the men who are really keen young investigators, and that is going to be a difficult problem, because there is more work that needs to be done than there are trained people to do it.

My own feeling about it, in answer to your specific question, is this: We know now that the funds available at anytime have been far insufficient to meet the research needs of the applications submitted for research projects. We know that so far we have been able to find the men and the tools to do the work.

I think in any continuing program—like the one of the NIAMD or the ARF or the American Rheumatism Association—there has to be a balanced program for each year. We must balance the funds we ask for research in terms of the total number of men that we can train.

I think that so far this is progressing well. Surely, we could use more in research today than is available through the NIAMD's funds. But I think it would be silly to say: "Multiply it by 10."

If we did that there would not be the men to carry it out; until we can also go on with a training program and train more men.

Mr. PRIEST. Your conclusion, as I gather it—and I think my own conclusion—is that we well might, in considering future appropriations, emphasize somewhere along the line some additional fellowship grants and training grants. I do not have the details of the program to tie it in with the appropriated funds; and additional emphasis on grants for fellowships and training. (Source: Statement of Dr. Currier McEwen, past president, American Rheumatism Association, and dean of the New York University School of Medicine, and Hon. Percy Priest, Committee on Interstate and Foreign Commerce, House of Representatives, pt. 2, p. 450.)

From the viewpoint of a National Institute director

The possibility of immediately enjoying a substantial increase in the number of these specialists seems remote. Of the 79 medical schools in the Nation, only 21 have complete neurological units for the training of personnel in this field; and there are only 151 available positions in the entire country which may properly be called neurological training posts. (Source: Dr. Pearce Bailey, director of the National Institute of Neurological Diseases and Blindness, pt. 4, p. 977.)

In many universities, medical schools and other medically related research institutions the absence of adequate laboratory space is the most important single factor restricting the volume and kind of medical research that they can undertake. The financial status of medical schools is such that very few can finance the construction of buildings from their own funds, or other private gifts. Federal funds for construction of laboratory facilities are needed.

Most witnesses, as indicated by the testimony, considered needs for research manpower and needs for research and teaching facilities as essentially 1 problem with 2 interlocking parts. Hence, needs for construction are interspersed in the general testimony cited above relating to the basic general needs of educational instructions. Some witnesses, as indicated by the testimony below, specifically singled out needs for facilities:

From the viewpoint of a professor of psychiatry

I would say we urgently need more research workers and more research facilities. More Federal aid must be authorized for the construction of such facilities and for the training and long-term support of skilled and gifted persons who will make a career of this essential work. (Source: Statement of Dr. S. Bernard Wortis, professor of psychiatry and neurology, New York University College of Medicine, pt. 4, p. 1037.)

From the viewpoint of a psychologist

Modern research demands equipment and modern scientific equipment is getting more and more expensive. Of course, you can run an entire psychological laboratory for years on the money it takes to build 1 cyclotron, $1 million or $2 million. But it's still true that the cost of laboratories and of scientific equipment is considerable. It is often thought by the public that the scientist is a queer duck who only needs a garret in which he can assemble a few old square boxes and some copper wire and the motors he has taken out of electric fans; but we cannot get new advances in modern science by continuing to treat scientists as poor relations. Mme. Curie and her husband worked in a freezing cold laboratory and in an unheated shed for years, but there is no reason to believe that their blowing on their fingers to get them warm enough to do their work actually helped their brains to operate better.

The mental health expenditures for research operations are very small, as we have seen, but the capital expenditures for laboratory space and equipment represents an equally discouraging picture. Research scientists must have tools and more space in which to use them. (Source: Statement of Dr. Fillmore H. Sanford, executive secretary of the American Psychological Association, pt. 4, p. 1060.)

From the viewpoint of a heart specialist

A number of places are very badly handicapped through lack of facilities: Laboratories and equipment. This is a very difficult type of money to get. The private agencies can afford to do very little of it.

So far as I am aware in the heart field, the only construction funds of any magnitude or importance were in the 1949 or 1950 fiscal budget for the National Heart Institute, when I think about $6 million was given, and 22 or 23 institutions were aided to develop more laboratory research space. That has proved an absolute godsend to those institutions, but there are now many that need such facilities, and among them are some of the best rheumatic fever workers in the country. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York City, pt. 1, p. 13.)

From the viewpoint of a medical school dean

Dr. McEwen. The other point would be construction grants. If legislation, Mr. Chairman, is required to make it possible to give that type of grant over and above the research grants that now can be made, then I think legislation is needed, but I do not know whether that is a question for legislation or not.

The problem of adequate stability of support for medical research cannot be dealt with solely by providing longer term support for relatively few outstanding investigators.

The bulk of medical research cannot be completed in 1 or 2 years. A stronger element of stability is needed throughout all the programs of public and private agencies supporting medical research.

The prevailing system of relatively short-term support for research projects, even though it has been modified so that much support is for periods of 3 to 5 years, poses difficult problems for institutions and for individual scientists. It seems clear that the private and Federal agencies administering research grants should—with the institutions concerned—pay increasing attention to means of resolving this important problem.

In the rheumatic fever field

Today we have with 50 or 60 able research workers of various and very different ages, working mostly in our medical schools and research institutes, only 7 jobs which give them any sense of security or continuity. I think they are all very secure intellectual individuals but whether they continue to do this work is dependent upon some group of individuals sitting far away from the place where the work is initiated and carried on. That is one of the serious difficulties today with relation to research support.

In addition to that, their running expenses are subject to short-term decisions by individuals outside of their own institutions and their own group; and I would believe that rheumatic fever, like all other areas of research in the health field, very badly needs funds which can be designated for use in such ways as to give assurance of continuity, so long as work is of a very high level of contribution.

I am not criticizing anyone. I mean this is what was developed in the last few years. It is inadequate in the way in which we give continuity and stability to those workers who have shown themselves worthy by the repetitive nature of the short-term grants, which are very disastrous to any operating research group; and I think we have not yet developed a satisfactory program whereby we can be certain that we are getting the very best potential personnel for research and utilizing them well. I think that is the key for future expansion and that something could be done. (Source: Statement of Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York City, pt. 1, pp. 13 and 131.)

In the cancer field

Now I would like to emphasize some of the difficulties of institutions such as ours. One of the difficulties is that grants are given on a year-to-year basis and under such circumstances it is very difficult for a general hospital to attract good research men when it is impossible to offer them a job for more than a year at a time. This is no criticism against the various donating agencies, be-

cause they have been most generous, to me in particular. Now it seems to me that if a contribution can be made and the research potential expanded one should take advantage of what large hospitals have to offer, and make it possible for them to offer research men a longer tenure than 1 year or 2 years at a time. (Source: Statement of Dr. Anthony Rottoni, St. Vincent's Hospital, New York City, pt. 1, p. 278.)

In the arthritis field

Research is costly, hazardous, and totally unpredictable. That is why all research must be viewed as a long-term undertaking. Only on a long-term, long-range basis does research pay worthwhile dividends. * * * The leads were never so promising and the need in these days of national emergency when manpower is at a premium is greater than ever before. * * * (Source: Statement of Gen. George C. Kenney, president, Arthritis and Rheumatism Foundation, New York City, pt. 2, p. 465.)

In the mental health field

Federal support of training and research has been emphasized by Secretary Hobby (of the U. S. Department of Health, Education, and Welfare) as being very appropriate Federal functions and great gains have been made through the partial realization of that principle. I say partial because much more could be done were the provision of research funds to the National Institute of Mental Health more extensive and more certain. A year-to-year support has its limitations for it forces a research worker to plan his work so that it can be completed within a 12-month period, when adequate pursuit of the research activity might call for a 5- or 6-year stretch. A short-term project is uneconomical and frustrating to those who have long-range plans. (Source: Statement by George S. Stevenson, M. D., the National Association for Mental Health, New York City, pt. 4, p. 1070.)

In the blindness field

In a clinical specialty such as ophthalmology, it is absolutely essential, both for teaching and research purposes, that * * * grants of any size be extended over a period of 5 to 10 years to attract and keep good scientific and medical personnel. The importance of tenure cannot be overemphasized. No amount of funds can insure success of research in the absence of continuity of effort. (Source: Statement submitted by V. Everett Kinsey, Ph. D., pt. 4, p. 1023.)

While of less fundamental importance than the problems of manpower, stability, training, and research facilities discussed above, significant problems exist in communication of research to the public, and in communication among scientists.

Progress in the conquest of disease depends not only on communication between physicians and researchers but also upon communication to the public at large. The widespread educational programs of such organizations as the American Heart Association, the American Cancer Society, and similar groups, are creating a growing public understanding of the nature of disease and the steps that are being taken to combat it.

The public has demonstrated eagerness to contribute to progress in medical science by giving generously to the many drives that have been launched in the effort to combat specific diseases.

A great deal is being done to educate the public to an understanding not only of disease but of the nature of research. However, some witnesses expressed apprehension of the manner in which research and research findings have been presented to the public. There was some uneasiness that overemphasis upon the immediate applicability of research findings might lead not only to unwarranted hopes, but also to failure to appreciate the length of the road ahead and the importance of supporting research with no demonstrable, immediate applications to disease problems.

Science is coordinated most effectively by scientists themselves. The major contribution which nonscientists can make to coordination of research is to help scientists communicate with each other, for coordination is automatic when communication is good.

Problems exist in opening these channels of communication and in keeping them open.

The most formidable is the vast amount of information being produced. Significant efforts are being made to organize information in various fields. A group of Federal agencies, for example, cooperatively maintain an organization which provides a running inventory of most grant and contract supported medical and biological research going on in this country. A number of organizations condense significant articles in broad fields.

Most of these services are hampered, however, by the constantly mounting volume of literature, by rising costs of publication, and by difficulties in finding and retaining qualified manpower. Additional financial aid for these purposes would facilitate communication.

Attendance at meetings, congresses, symposia, and conferences is one of the most effective means of communication among scientists. Most private and governmental research-supporting organizations recognize the value of such travel, and grants in support of research usually provide small amounts of money for assistance of travel. However, this is rarely enough to cover the needed travel, particularly to overseas points.

A particularly serious aspect of this problem, brought to the attention of the committee by a university scientist, is that of the very rigid limitation of such travel funds available to scientists:

> If we are going to hope for real cross-fertilization of the mind and further development of our Heart Institute as well as the other public-health institutions, it is absolutely important for the men working in those institutions to have the money to attend the scientific meetings without stint. This is one of the most important ways in which they can bring knowledge back to the public-health institution and, in turn, have it disseminated to the States and at other national meetings. (Source: Testimony of Dr. Robert W. Wilkins, vice president, American Heart Association, Massachusetts Memorial Hospital, Boston, Mass., p. 27.)

CHAPTER III

ATTACK ON DISEASE BY PREVENTION, CONTROL, AND REHABILITATION

A. PROBLEMS VARY WITH THE DIFFERENT DISEASES

The health inquiry clearly brought out that the control procedures for the different diseases vary considerably.

First, they vary because of the different ways that disease affects people. (Some diseases cause only mild discomfort—others cause disability and suffering and premature death.)

Second, they vary according to the degree of public understanding and knowledge about the disease. (People have heard much about tuberculosis and cancer and diabetes, too little about mental illness and blindness.)

Then, too, they vary according to the amount of emphasis given to certain diseases by both private and public health organizations. (The national voluntary organizations have given a great deal of attention to cancer, heart disease, and poliomyelitis, while State and Federal Governments have provided hospitals and other facilities for mental diseases and tuberculosis.)

Most important, however, is the degree to which control programs vary according to the available scientific knowledge. The health inquiry brings out the relationship of existing knowledge to the effectiveness of the disease-control procedures in four general categories, listed below with some illustrations drawn from the testimony.

1. When the cause of the disease and certain control procedures have been developed

Tuberculosis.—Dr. Esmond Long comments on the value of having the facts by stating that—

> application of the knowledge we now have would eradicate tuberculosis (p. 555).

He further comments on the recent advances made because of increased scientific knowledge as follows:

> In recent years the treatment of tuberculosis has been enormously improved by the introduction of new drugs and the use of new principles in thoracic surgery. The three most effective drugs are streptomycin, isoniazid, and paraaminosalicylic acid. Combinations of these drugs have been found particularly valuable. Surgery of the lung, once a very difficult procedure, has become safe and effective, thanks to improved surgical technic, the availability of the new drugs and modern anesthesia. The most spectacular advance has been in the excision of diseased tissue. Before the new drugs were available this was a dangerous procedure.
>
> Drug treatment and surgery have been aided by noteworthy laboratory advances. Bacteriological studies, for example, have brought to light the most effective combinations of drugs, and have led to practical methods for preventing the development of resistance of the germs of tuberculosis to the drugs used against them. Physiological studies, in turn, on the working capacity of the lungs, have enabled surgeons to determine safe limits in operating for tuberculosis, and to estimate the degree of functional impairment caused by loss of lung tissue.

Diagnostic aids, including better X-ray equipment and other testing materials, have become available, and the differential diagnosis between tuberculosis and certain similar diseases has been greatly improved.

Poliomyelitis.—The fact that the causative agent of polio has been known for some time has led to the hopeful outlook for the development of a suitable vaccine.

Much progress has been made in recent years in preventing or reducing the extent of the late crippling effects of this disease. This progress is stated by Dr. Charles Wise as follows:

What can be done in the way of treatment for these patients? Perhaps I might just in a very brief and limited way outline what in general is being done for the paralyzed poliomyelitis patient today. After the patient's acute illness is over, when the need for a lifesaving measure such as the respirator and other acute medical emergencies has passed, the problem then becomes one of rehabilitation. Many advances have been made in the past 2 decades in the management of the paralyzed poliomyelitis patient.

These are just a few medical points. First, we can now perhaps limit deformities even in the more severely paralyzed patient to a greater degree than we ever could in the past. We do not see the severe deformities nearly as frequently today as we did in the past. That is physical therapy, early orthopedic attention, prevention of contracted muscles and contractures about the joints, deformities of the spine, et cetera. These improvements in technique and physical therapy, physical medicine, nursing care, can largely be attributed to the stimulation of the National Foundation for Infantile Paralysis in spreading throughout the country knowledge of proper methods and techniques on early care of the paralyzed patient.

2. *Where control depends on early case finding and treatment even when the exact causes are not known*

Cancer.—There is much to be learned about cancer, but important advances have been made during the past few years because of the tremendous increase in public education and further development of early case finding and treatment. Dr. Charles Cameron states progress as follows:

Cancer information is given wide attention in newspapers, magazines, on the radio, and television. X-rays are being generated at higher and higher voltages and targeted with increasing precision, while radium or its new substitute, radioactive cobalt, are available widely throughout the country. Surgery has boldly extended its frontiers so that there is virtually no part of the body now sacred before the scalpel. Virtually everything we know today about cancer has been learned in a single generation, yet we are still in the green years of medical progress and there is no evidence to justify the resignation or apathy in respect of future progress in the control of this disease.

The belief that an effective program in cancer control will pay off is expressed by Dr. Cameron as follows:

In an analysis of the effectiveness of this type of preventive medicine—preventive in the sense of preventing deaths—the American Cancer Society studies the cancer yield in some 52,000 examinations conducted in 90 detection centers. It was found that the rate of cancer for the entire group of examinees unselected as to age was eight per thousand. The rate of cancer discovered varied from 1.2 cases per thousand for the group under 30 years of age, to 34.3 per thousand in the group aged 60 and beyond, with, as was to be expected, a progressive rise in the cancer yield with advancing years. These facts suggest that, while it may be impractical and, indeed, impossible, to examine the entire population for evidence of cancer or other disease on a regular schedule, nevertheless an approach to effective chronic disease prophylaxis might be achieved through the establishment of such screening devices as selection according to age. Thus, it seems poor economy to attempt to find cancer under the age of 40. It appears distinctly worthwhile to do so in persons beyond the age of 50.

Mental illness.—Even though much of the testimony on mental illness concerned the magnitude of the problem and the public reaction to mental diseases, there is hope expressed that progress is being made. Dr. Francis J. Braceland states:

> Twenty years ago, involuntary melancholia, a disease affecting women in middle life, was a great problem. Incidentally, men in middle life have problems, also, although they are not quite as dramatic. Then it was known that two-thirds of those people had hopeless prognoses. Now the recovery rate, due to new forms of treatment and due to a different concept, is well up to 70 percent.
>
> That is a particularly distressing disease. It is one which used to disturb the young physicians most. As you took the wife of a man from him at a mental hospital door in good condition, you knew in your own mind's eye that within a period of 8 months one would hardly recognize her. It was a distressing, depressing, unsettling type of thing to deal with. That has been helped immeasurably. It has also been helped in the way that all of these things are going to be helped; by a combination of public and private collaboration and cooperation and the use of funds in research and in teaching and in the use, also, of the private clinics and the clinics for the public in the various cities.

Mr. Priest expresses the progress made as follows:

> Before asking 1 or 2 questions, I want to make 1 brief observation. Granted that we still have a long and perhaps tortuous road to travel before we reach anything like an ideal government, I feel the last few years have brought out developments that are thrilling in this field. Seeing the presence of Drs. Braceland and Wortis and Felix and Stevenson will recall the discussion we had as to whether it should be called a neuropsychiatric institute or a mental-health institute, and we decided it should be called the mental-health institute. At that time, looking to the original concept of the legislation, this committee felt, I am sure, that in addition to providing a central national place for research into cause and diagnosis and treatment, that this program would result in a great impetus throughout the country at the State and local level in mental health. That has been one of the thrilling episodes throughout the country. I have noticed a change in the public attitude toward mental illnesses. It is no longer considered a disgrace to have in the family someone who is mentally ill. A few years ago it was something people tried to hide, and talked about in secret. I have seen that change in my own hometown. I think we have attained that one goal quicker than I thought we would.
>
> As a part of this brief observation, I want to pay a public tribute at this time to a gentleman who was at that time a member of this committee and who is not now a member, the gentleman from Ohio, Mr. Brown. He was the ranking minority member of the subcommittee that handled this original legislation. We realized that in going to Congress with that proposal, except for the members of this committee who knew what we wanted to do, we were facing some members who held the thought that mental health was something we could do nothing about. I recall the day before it was planned to bring the bill before the House, Mr. Brown called me and said, "Percy, we have the touchiest selling job we have ever had. I will stand firm as possible and be as persuasive as possible." I wanted this record to have that personal tribute to the work Clarence Brown did on that bill, because without it it would have been impossible to get it by. It was difficult at best.

3. Where more knowledge is needed for control, but limited control programs have been developed

Heart disease.—Althought much has been learned about heart disease during the past 30 to 40 years, the obstacle to control still is the need for more knowledge. Dr. Irving Wright states it as follows:

> Lack of knowledge is the greatest present obstacle to the fight against heart disease.
>
> Although there are more than a score of different forms of cardiovascular disease, three of them are responsible for the bulk of heart and vascular damage. These are hypertensive heart disease, coronary heart disease, and rheumatic heart disease. The basic causes of none of these disorders is as yet fully understood. It is clear, then, that decisive progress in controlling heart disease

depends on the acquisition of new knowledge. For this reason the program of the American Heart Association has rested, from the beginning, on a foundation of research.

The testimony likewise points out a number of important things that are being done in the employment of heart disease patients. Such projects as that of the New York Heart Association (p. 115) in the development of a model heart kitchen for the cardiac housewife is of great interest and importance.

4. Where little is known regarding either cause or treatment

Neurological diseases.—The testimony on this group of diseases involving neurology, blindness, cerebral palsy, muscular dystrophy, multiple sclerosis, and epilepsy presents a rather dreary outlook. Dr. Cornelius Traeger states it as follows:

I want to speak for the neurological and sensory diseases—the neglected and forgotten ills of mankind—among them both chronic and infectious diseases.

The number of persons dying from neurological and sensory disorders is exceeded only by the number of persons dying from cancer and heart disease.

The number of those presently affected by neurological and sensory disorders, which are of grave or less serious importance, may be estimated conservatively at about 20 million people. That is a great many citizens.

For most of these diseases the causes are unknown and no specific treatment is available. They chiefly affect children and adults in the very prime of life. Of course, that does not exclude us oldsters, as we also get neurological diseases, but the greater majority of these people are the productive manpower and womanpower pool of this country.

It was emphasized by the chairman that the broad concept of neurological and sensory disorders constituting a major health problem in the United States has only recently gained roots.

The need for public understanding about this group of diseases is emphasized by Dr. Traeger as follows:

Another reason is that there has always been a great deal of mystery about the brain, which has tended to diminish research efforts in this field. For example, when I was a student, and for a great many years after, neurology was described as a science of diseases for which nothing could be done. This we are hoping to change.

Another very important reason is that the nervous system—that is, the brain and spinal cord—are enclosed within a rigid bony envelope—the skull and the spinal bones—which makes exposure difficult and often hazardous. You cannot go chopping into a man's brain to do research. It is a difficult and dangerous procedure, and the same thing is true with operations on the spinal cord.

Still another reason, equally important, is that many of these neurological disorders have been surrounded frequently by an aura of shame or guilt or social embarrassment. The patient with epilepsy or cerebral palsy or multiple sclerosis is ashamed of his disease and often tries to conceal or to minimize the external manifestations of his disease. The relatives of such patients are too often shy in regard to the afflicted ones. The patients and their families are loath to discuss the matter and are reluctant to seek others to speak for them.

It is for these reasons and others that only a small portion of the funds appropriated for scientific research have been made available for investigation of these disorders.

Blindness as caused by diseases within the eye was considered as a separate problem in the hearings. Here, too, the need for more knowledge was emphasized by Miss Mildred Weisenfeld:

However, the unsolved problems in the field of eye diseases remain many—cataract, glaucoma, optic atrophy, detachment of the retina, certain corneal opacities, retinitis pigmentosa—are but a few for which cause and adequate treatment are unknown to science. The specialty of ophthalmology is young, and the ground is fertile for pioneering effort. The unexplored areas are awaiting the initiative and genius of our modern scientists. Those who wish to delve into

these unknown fields for the benefit of mankind must be encouraged with adequate financial support, facilities, and equipment. It would be unjust and a tragedy unnecessarily perpetrated on countless thousands to deny this support.

The dearth of dollars must not be allowed to stand as a barrier to progress which can mean hope in place of despair, sight instead of blindness.

I repeat, the voluntary agency cannot yet assume this enormous responsibility alone. It can only be met with Federal aid.

Hearing defects.—The testimony on this subject brought out the need for better methods of case-finding and the need for better public understanding. Dr. William Hardy stated the problem as follows:

The general problem of hearing defects and hearing disorders continues to be widely misunderstood and misapprehended, perhaps largely because a hearing disorder does not show as a human disability; it does not have a mortality rate; the fear of continued welfare does not show. What shows is the effect of noncommunication or interference with communication in terms of some of the psychological aspects of being able to converse freely, and that results in a real disability.

Much of the testimony on hearing defects was the emphasis on the need for better early case-finding technique so that correction and prevention of progression can be effected.

Arthritis, rheumatism.—The need for greater knowledge in regards to this problem is brought out by Dr. Currier McEwen as follows:

The CHAIRMAN. If you wish to answer this question in the same way, do not hesitate to do so.

Do you think the average practicing physician in this country is adequately trained to take care of an arthritic patient? That is, do we have enough specialists in this field? Do we have enough clinics? How do we compare to England in this respect?

Dr. MCEWEN. That is always a difficult question to answer, because you have to define what is "adequate", do you not? I would say this: That the average physician in this country, I would think, is probably as competent to take care of these problems as the physicians of most any other country. But if you think in terms of adequate care being that care which makes use of the latest information and the finest skills in it, then certainly the answer is that there are a very small number of physicians in this country who are fully skilled in these diseases.

Gen. George C. Kenney states the problem in another manner as follows:

There is no doubt that arthritis and rheumatism have earned the unenviable right to be identified as the greatest cause of chronic illness and disability in the United States today. Of the more than 10,104,000 suffering from the rheumatic diseases, more than 4,500,000 actually have arthritis. Though there is a great deal about these diseases that is not known, there has been comparatively little research to learn the nature, the cure, and the prevention of them.

There are two reasons for this. First, the fact that so little of scientific value has been known about these diseases. Second, that most types of arthritis and rheumatism are not quickly fatal. Unlike many other diseases, arthritis and rheumatism rarely are a direct cause of death, though recent studies indicate that they help shorten the life span of those who are afflicted. But because the fear of death does not exist in arthritis, the public interest and support has gone first to those diseases that kill outright.

He further emphasized the problem of managing this disease as follows:

As important as basic research is, perhaps the biggest problem that exists today in the field of the rheumatic diseases is the training of more physicians in the diagnosis and treatment of arthritis and rheumatism. In many sections of the country the Arthritis and Rheumatism Foundation has been unable to organize clinics and to launch medical progress to aid thousands of sufferers simply because there aren't enough doctors available who are skilled in this field.

At present there are only about 750 physicians in the United States who have been specifically trained to diagnose and treat the rheumatic diseases. This means that there is 1 specially trained physician available for every 165,0000 persons in the Nation, or 1 rheumatic specialist for every 8,000 persons afflicted with arthritis and rheumatism.

Diabetes.—Although much scientific knowledge regarding the treatment of diabetes has evolved since the discovery of insulin, much needs to be known to effect better control and preventive measures. Dr. Arnold B. Kurlander emphasizes the need for more knowledge as follows:

1. *Determination of etiological factors in diabetes and its complications.*—Diabetes may be precipitated or forecast by things and events of which we yet know little. These must be sought out. For example, recently it has been shown that in some women pregnancy is such a stress that tests employed during pregnancy may forecast the later development of diabetes in the mother and future trouble for the child. The exact etiology of diabetes and its complications has not been determined. The relationship between good control of diabetes and prevention of complications remains to be more certainly fixed. What constitutes control good enough to prevent complications is to be determined. Many of the complications of diabetes, particularly those associated with atherosclerosis, appear to be disorders of fat metabolism. The etiology of and necessary preventive measures for diabetic retinitis are also fields for study.

That some control measures can be put into effect in the absence of all the knowledge is stated by Dr. Kurlander as follows:

Despite the fact that the etiology of diabetes is not completely known, sufficient scientific advances have been made to warrant immediate and substantial increase in public-health efforts directed to the control of the disease. A significant one of these is early casefinding of the disease, which should result in reduction of complications and premature death.

Yet another aspect of the variations in control programs related to specific diseases is the proportion of emphasis given to one disease over another at medical schools, perhaps due to the urgency of the disease problem in terms of human suffering and subsequent demands by the sufferers. The emphasis does not always appear to be in proportion to the burden certain diseases place on public and private agencies. For example, the testimony brought out very forcibly the tremendous, ever-increasing burden that mental disease places on the public and at the same time the relatively little positive action taken toward prevention or control for a variety of reasons. Some of these factors are emphasized in Dr. Robert Felix's testimony regarding mental illness:

If the present birth rate remains constant, if the number of mentally ill who are hospitalized remains constant, and if the cost for hospitalizing the mentally ill remains constant, each year's crop of new babies will, because of the percentage of them who will go to mental hospitals, cost the taxpayers—this is just the taxpayer and not any private foundation—$800 million before they die.

The CHAIRMAN. It is time somebody began to think about this in a very serious way.

Dr. FELIX. I wish to God they would, Mr. Chairman. We have many people working in this field, but we sometimes get a little heavy hearted. Not through any fault of the Congress, because they have been most generous, but there is so little public understanding of the problem. If the whole Nation would begin to understand; if people would work for their State hospitals and mental-health clinics in their communities and assist their schools to develop better guidance programs for the students who are having problems; if we could do something in the field of marriage counseling to save homes that are breaking apart because of psychological reasons, much could be done. These things mean as much as the funds which you and those in the upper House between you appropriate for the program which I have to administer. I do not mean by this, gen-

tlemen, that I could get along with less, but that is one aspect of the program and public understanding and support are other important aspects.

For some reason or another, gentlemen, there seems to be a feeling among many of the people in our country—the people on the highways and byways and my home in Kansas and your home wherever it may be—that if you forget about mental illness and ignore it, it will go away. There is another thing I would like to mention. And this is something that I wish someone, maybe some of you gentlemen who are experts in public life and know how to sound out the opinions of people, could suggest methods of handling. If a person other than we who are professional psychiatrists, psychologists, and so forth, shows an interest in mental illness and begins to push for increased attention to the problem, immediately you will see people who will begin to look at him out of the corner of their eyes and wonder why he is so interested. They suspect something happened to him or some member of his family.

B. COMPLEMENTARY CONTROL MEASURES

It is apparent that even partial control of many diseases requires more than purely medical measures of diagnosis, treatment, and prevention. While there cannot be any sharp dividing line between direct and complementary control measures, it would be useful to mention some of those activities which, in the opinion of experts, are helpful in the application of medical techniques.

Perhaps the most important of these supportive measures is public education and the bulk of this section will be devoted to this topic. Other activities complementary to control programs include such things as community tumor registers to which hospitals and individual physicians report cancer cases under their care. These registers greatly aid accurate determination of the extent of the local cancer problem, the results of various forms of treatment, and provide a helpful key to several important followup services. In the same general sense are the social and welfare services afforded in communities with well-developed chronic-disease control programs. These services help the patient and his family by assistance in meeting the social and economic problems that frequently are involved. Of like nature are the home-nursing and nursing-aid services provided by health departments, public welfare agencies and voluntary organizations.

Another good illustration of the numerous and often vitally important services in support of direct control efforts is the program of the National Heart Institute for training laboratory technicians. Teams of experts furnished by official and voluntary health agencies move from State to State to provide intensive training for technicians in laboratory methods for accurate determination of the blood-clotting capacity of individual patients. With this information, physicians are enabled to make the most effective use of certain new drugs that have become available for treatment of some forms of heart disease.

The efforts of public and private health agencies, industrial and commercial firms, insurance companies, and others to encourage periodic physical examinations are another example of programs serving an extremely important function in the control of many diseases.

As stated above, one of the most vital measures leading to the control of almost all important diseases is public education. This public enlightenment is needed in many instances to appraise people of the existence and the extent of the diseases themselves. This is especially true of diabetes, early cancer, and certain other chronic and degenerative diseases.

The solid need for education is forcefully illustrated in the cancer field:

Cancer of the breast, treated under the best circumstances today while the disease is confined to the breast, can be cured 7 or 8 times out of 10. Of all cases with breast cancer in the United States, we are not curing more than one-third. Cancer of the neck of the womb—leading cause of death from cancer among women—is now curable 7 times out of 10 when it is treated while the disease is confined to the cervix; we are not curing more than 20 percent of cancer of the cervix in this country. Cancer of the mouth is curable in two-thirds of the cases when it is treated while the tumors are no bigger than my little fingernail. Countrywide, we are not curing more than one-third of our oral cancer. Now, this disparity is identifiable for almost every form of cancer and it is the basis for the program of education and control, which I trust will be elucidated in more detail as the days go on.

In aggregate, what I have said means that it is possible today to cure one-half of all cancer. We are actually curing only one-half of that half. (Source: Statement of Dr. Charles Cameron, scientific and medical director of the American Cancer Society, p. 201.)

To meet this need the American Cancer Society has conducted an intensive campaign:

Recognizing the critical importance of time, or delay, in influencing the results of cancer treatment, a group of doctors in 1913 recommended the establishment of a voluntary organization whose objective it would be, among other things, to develop and carry on a broad program of public education. Specifically, the program would seek to inform the laity of the early warning signs of cancer and to make clear the importance of immediately heeding them. Today this program of public education continues and its basis is the seven danger signals of cancer. Every medium of communication and public information is utilized in promulgating this information: Printed pamphlets, motion pictures, radio, television, exhibits, window displays, billboard posters, car and bus cards, bulletin-board handbills, special mailings, and talks by properly qualified persons to groups and assemblies of many kinds, such as women's clubs, parent-teacher associations, church guilds, industrial groups, and mass public meetings.

Recent studies offer evidence that this 40-year-old effort in health education of the public has borne fruit. Virtually every study of the trend of the factor of delay for which the patient is responsible has shown a consistent lowering in the element of delay. To put it another way, more patients are being seen with earlier cancer than ever before. These findings are substantiated by the experience of most practicing physicians who have commented on this facet of the problem. (Source: Statement of Dr. Charles Cameron, scientific and medical director of the American Cancer Society, p. 143.)

The immensity of the task of educating the entire population of the Nation is shown by looking simultaneously at the cure rate and the educational campaign.

The American Heart Association conducts a similar campaign, and for the same essential reason. Many forms of heart disease can be dealt with best if people know enough to seek help early.

The relative role of private and public effort in this field varies. In some disease areas, the effort is a joint one, as shown in the heart field:

The observance of the collaborative principle on the part of the groups interested in the cardiovascular disease problem is significant. Coordination is being achieved by the various agencies through the interchange of information and by a truly cooperative spirit. The American Heart Association and its affiliates, other interested voluntary organizations, foundations, and privately financed groups, mutually share the responsibilities with public agencies. An exemplification of this is particularly evidenced in the close working relationships between the American Heart Association and the National Heart Institute. The collaboration is not passive, but active and positive.

The National Heart Institute's existence and place in this partnership is another manifestation of the crystallized recognition of the importance of heart

diseases. The National Heart Institute and its program also mark acceptance by the Federal Government of its responsibility in this problem. (Source: Statement of the National Heart Institute, p. 69.)

In other areas, as in the case of tuberculosis, the load of education is carried almost entirely as a private task:

Little of the Public Health Service's resources are used for direct services in public education. The National Tuberculosis Association has been actively engaged in public education since 1904, and its effective work in this field permits the Federal effort in the TB field to be directed toward areas where private efforts have to be supplemented. Public Health Service participation in public education is limited to consultation and assistance to National, State, and local groups. Aid to professional education, on the other hand, is provided by both the Public Health Service and the National Tuberculosis Association, since neither has had resources adequate to do the total job. (Source: Statement of the National Tuberculosis Association, p. 561.)

C. REHABILITATION

No program of a health nature can be considered to be fully adequate until it provides for the total needs of a diseased person from the time he becomes ill until he assumes his rightful place in his home and community. It is important of course to prevent disease and alleviate human suffering, but the Nation's economy and its ever-increasing groups of older people critically need to have the mentally and physically disabled persons assuming an active part in home and community life. The welfare of the individual, his family and his community are all better served when the afflicted person is properly taught to compensate for the crippling effects of his disease that has been remedied insofar as possible. Rehabilitation is both a health and vocational attack that may lack some of the glamor of other health programs, it will still remain a sizable problem as an aftermath of many diseases even after we may some day hopefully prevent some of them. Thus rehabilitation is a major weapon in dealing with the consequences of diseases. One witness said:

To the individual patient who has poliomyelitis today or to the member of a family of a patient paralyzed with poliomyelitis, despite the exciting news of prevention in the future, the actual treatment and rehabilitation of the patient is still the No. 1 problem.

We consider rehabilitation as the preparation of the patient physically, mentally, socially, and vocationally for the fullest possible life compatible with his ability and disabilities.

As for the life expectancy increases, as degenerative diseases and associated disabilities increase, as there are improvements in surgery, and as defenses against infectious diseases are found, all of these things will save lives but yet put a greater burden on medical science and the community for rehabilitation purposes. (Source: Dr. Charles S. Wise, professor of physical medicine and rehabilitation, George Washington University School of Medicine, pt. 3, pp. 855–857.)

Another witness stressed that—

In those areas where science and medicine still have not found all answers—in cancer and heart and in the major neurological diseases including blindness and deafness and many other things that result in crippling conditions for people—the only thing we have to offer, really, after the disease has once been contracted and medical science has done all that it can in the way of treatment, is rehabilitation. (Source: Miss Mary E. Switzer, Director of the Office of Vocational Rehabilitation, Department of Health, Education, and Welfare, pt. 3, p. 813.)

In nearly all of the disease conditions covered, rehabilitation was recognized as being essentially interdependent with prevention and

research. As one witness put it, after describing graphically some of the current social and employment handicaps under which persons with epilepsy struggled to be self-supporting:

Basic research must be carried on, but public education, too, must be carried on, as well as rehabilitation, so that we can make use of the abilities and capacities of these people, as they exist right now. You just cannot tell an individual to wait until something comes out of the laboratory. (Source: Dr. Harry Sands, executive director, Epilepsy Association of New York, pt. 4, 987.)

Rehabilitation, encompassing needed medical care, vocational counseling, education or retraining, and placement in work suitable to the individual's abilities, has fully justified its expenditures.

In 1952, nearly 67,000 handicapped persons were rehabilitated by the State-Federal program of vocational rehabilitation. Of this number, more than 48,000 were not employed at the time services began. Their combined earnings before rehabilitation amounted to $16 million a year.

After rehabilitation they were earning wages at the rate of $116 million a year. An estimated $10,400,000 in Federal income taxes will be paid by these persons annually. At this rate it will take less than 3 years for these rehabilitated individuals to pay back into the Federal Treasury in income taxes alone the entire $21 million in Federal funds spent on their rehabilitation. Few investments pay such excellent dividends. Even if the costs of surgery, appliances, and other special expenses doubled, this would still represent a very high return on investment. (Source: Mr. Lawrence J. Linck, executive director, National Society for Crippled Children and Adults, Inc., pt. 4, p. 1,025.)

In 1951 the public vocational rehabilitation programs:

* * * rehabilitated about 63,000 or 64,000 people * * * of whom 4,000 were polio patients. * * * They were a young group * * * so only a small proportion of them had found their way to the relief rolls. They were, rather, supported by their families and others. Most of them were unemployed when they needed and applied for rehabilitation. They were earning about $728,000 a year then. After rehabilitation, when they had been in their first job from 3 to 6 months they were earning $7.4 million a year.

* * * For the 64,000 people who were rehabilitated last year, and you realize that the large majority of them were not employed and that about 12,000 of them were on relief and had been on relief for a number of years before they were rehabilitated, you get a little better picture of what rehabilitation means in the long pull. (Source: Miss Mary E. Switzer, Director of the Office of Vocational Rehabilitation, Department of Health, Education, and Welfare, pt. 3, pp. 816–817.)

We are getting around 400,000 new cases (of arthritis) a year * * * and that is a conservative estimate, just as the 10 million figure is a conservative estimate of the total.

From the standpoint of the national economy, it is good business to treat these arthritics. Each year the wage earners are losing approximately 960 million man-hours of labor due to the rheumatic diseases * * * The old attitude of doctors that nothing could be done for the arthritic has really got to give way to the proven fact that something can be done for any arthritic and that the great majority of them can be restored to useful productive life. The doctors themselves have given me the estimate that at least 70 percent of these sufferers can be put back to work and can be restored to something besides mercy.

* * * We can find skilled labor in that 70 percent that can be put back to work. (Source: Gen. George C. Kenney, president, Arthritis and Rheumatism Foundation, New York City, pt. 2, pp. 466–467.)

Current rehabilitation programs of both governmental and voluntary agencies are now serving only a fraction of those disabled persons who need such services.

We have insufficient numbers of trained rehabilitation personnel of all kinds—physicians skilled in rehabilitation, physical therapists, occupational therapists, social workers, and vocational counselors.

Many physicians do not as yet understand the value of rehabilitation or incorporate rehabilitation techniques in their day-to-day practice. The teaching of rehabilitation as an integral part of medical care is proceeding only slowly in medical schools.

All public vocational rehabilitation programs are inadequately financed to meet the backlog as well as the new cases of disability produced each year by disease, injury, and congenital causes.

We have far to few rehabilitation facilities in hospitals, and too few rehabilitation centers located strategically throughout the country so that severely disabled people can be restored to maximum functioning as near as possible to their home communities.

Research in rehabilitation principles and methods is urgently needed as a basis for improving rehabilitation practice.

Public and employer understanding of the capacity of disabled persons needs to be increased if their full contribution to the Nation's economy is to be realized.

In relation to the size of the load, one witness said:

* * * There are probably 2 million to 4 million to 6 million, depending upon whom you count and whether you count people in institutions or include the mentally ill or not, who should be benefiting from vocational rehabilitation * * * and who would be productive workers if they were able to have the services. Each year about 250,000 more are added to that backlog. (Source: Miss Mary E. Switzer, Director of the Office of Vocational Rehabilitation, pt. 3, p. 815.)

Of an estimated 314,000 blind persons in the United States, about 36,250 are considered employable in sheltered workshops and home industries, and another 36,250 are regarded as employable in industries and professions.

* * * Our Federal and State Governments are spending, annually, about $12 million to administer programs of vocational rehabilitation for blind individuals, as compared with an annual amount of $70 million spent for public assistance and medical care for the blind. (Source: Miss Kathern F. Gruber, assistant director, American Foundation for the Blind, Inc., pt. 4, pp. 997–998.)

In relation to the outstanding need for qualified rehabilitation personnel, another witness commented:

* * * We came up with the idea we were at this moment in rehabilitation where we were 20 years ago in scientific research. You have to train people qualified to carry out the result of scientific research. Today we are not training enough people who have an understanding of rehabilitation work * * *

We are trying * * * to establish training centers in university hospitals where every medical student will be familiar with the total concept of rehabilitation. At the same time, graduate students are learning the techniques of rehabilitation. There are 78 medical schools and I would hope there might be sufficient money to do this in all 78 medical schools * * * If every student who graduate from medical school realizes that something can be done, he, himself, can do something in his local community through the process of screening and sending to those centers the most complicated cases. (Source: Dr. Hart E. Van Riper, medical director, National Foundation for Infantile Paralysis, pt. 3, p. 821.)

In epilepsy, which affects an estimated 1.5 million people in this country, new drugs have been discovered that can control seizures in about 80 percent of the cases. The cost of such treatment to each individual is about $100 a year.

In spite of these advances, the stigma of the disease and lack of understanding on the part of the public generally have delayed the rehabilitation or large numbers of epileptics. As one witness put it:

I have yet to see a patient with seizures who is working and carrying on his job at the level of his own capabilities * * * Everyone * * * certainly would

have been doing a better job and would have been working at a higher level were it not for his seizures.

Even though an epileptic can be employed—and it is difficult if he is an epileptic—he is still not doing as much for the community as should be done. (Source: Dr. F. M. Forster, professor of neurology and dean of Georgetown University Medical School, pt. 4, p. 885.)

The core of the rehabilitation job is, of course, services to physically and mentally disabled people that will enable them to be self-supporting or, at least, to care for themselves to the maximum degree possible. Rehabilitation represents a—

blending of services from the fields of medicine, social work, psychology, education, and employment. (Source: Statement prepared by the National Institute of Mental Health, PHS, pt. 4, p. 1120.)

But the total rehabilitation job facing the American public looms much larger, for it involves not only provision of services but manufacturing the tools for those services (research), training professional personnel to use those tools, and the construction of facilities of various kinds in which the tools of rehabilitation can be used most effectively.

The resources of both governmental and voluntary agencies, therefore, must be brought increasingly into the attack upon disability.

The substantial contributions toward support of professional training for rehabilitation personnel and research in rehabilitation which the National Foundation of Infantile Paralysis, the National Society for Crippled Children and Adults, the American Heart Association, and numerous others have formed the basis for a workable partnership with public agencies.

The importance of such partnerships was stressed repeatedly. For example:

* * * The National Society for Crippled Children and Adults believes the problem of crippling in general, and crippling as a result of neurological diseases in particular, to be a tremendous one requiring all the energies of public and private agencies to meet. Additional funds and additional numbers of trained personnel are critically needed to provide and staff services and facilities which will bring to the crippled of our country all of the techniques of rehabilitation of which we now have knowledge. Similarly, there is an urgent need for vastly increased research efforts in fields where we already have reason to believe heartening results can be realized and in fields not yet explored.

Speaking as a voluntary agency whose strength lies in the local communities where direct services must be provided to reach the individuals in need of them, the national society pledges its financial support to research, to the limited extent to which it has funds available, while increasing its programs of care and treatment, and education to keep pace with research developments which we believe will be made possible through adequate appropriations for the National Institute of Neurological Diseases and Blindness. (Source: Statement by Lawrence J. Linck, executive director, National Society for Crippled Children and Adults, Inc., pt. 4, p. 1,027.)

Several witnesses pointed to the need for integration of rehabiltation and basic medical education. One said:

You cannot build on a solid foundation with continuity of operation in the field of research or rehabilitation, unless it is tied in closely with the mainstream of medical education, which must be supported and expanded. (Source: J. M. Ulmer, Cleveland, Ohio, formerly member of the Advisory Council on Neurological Diseases and Blindness, pt. 4, p. 1,021.)

Rehabilitation is both an integral part of medical treatment and an extension of nonmedical services. Sometimes new medical or surgical advances open up new opportunities for the rehabilitation

of patients formerly condemned to inactivity or uselessness. An example is cardiac surgery of patients with longstanding rheumatic heart disease. Now cardiac surgery, supplemented by wise counseling and job placement, or perhaps even by complete retraining for a new vocation, is making rehabilitation a reality where once no hope was possible. As one witness said:

Surgical correction of valve deformities * * * is an important feature in helping some of the adult individuals with crippling heart disease to resume reasonable active existence. (Source: Dr. T. Duckett Jones, medical director, Helen Hay Whitney Foundation, New York City, pt. 1, p. 12.)

Rehabilitation must be directed not only to the new cases of disability arising each year, but must also concern itself with old cases. Even if a cure or a sure method of preventing a disease were found this year, we would still be confronted with the urgent need for rehabilitating those disabled in previous years. People paralyzed as a result of poliomyelitis offer outstanding examples of significantly large backlogs of disability.

The National Foundation for Infantile Paralysis from 1938 through 1952 spent $145 million for patient care. By the end of 1953 it is estimated that more than 258,000 patients will have received direct financial assistance, in whole or in part, from the National Foundation for Infantile Paralysis. In 1952 alone the patient-care program expenditures were $24,910,000 for aid to 80,000 poliomyelitis patients, more than half of them victims of previous years.

The long-lasting effects of this disease are illustrated by our finding during the first 4 months of 1953, that of 6,064 poliomyelitis patients admitted for treatment, 1,031 had their initial attack in 1938 or before; 388 in 1943 or before. During 1953 the national foundation still was paying for care for some victims stricken in the 1916 epidemic. (Source: Dr. Hart E. Van Riper, medical director, National Foundation for Infantile Paralysis, New York, pt. 3, pp. 770–771.)

Diabetes mellitus, too, is a disease which produces disability that must be dealt with over many years. In the treatment and rehabilitation of diabetics there is not only the continuing problem of control, but also the probability of secondary complications. The estimate that "diabetics are disabled about 15 percent of the time" suggests the enormous loss of this serious crippling disease which affects an estimated 2 million people in the United States and indicates the continuing need for both medical care and rehabilitative services throughout the course of the disease. (Source: Dr. Arnold B. Kurlander, Assistant Chief of the Division of Chronic Disease and Tuberculosis, Public Health Service, pt. 2, p. 537.)

Rehabilitation, like research and control, must be cooperatively undertaken by both governmental and voluntary agencies. In the first place, the total job is far too large and too complex for any single-headed attack.

Secondly, voluntary agencies have gained valuable experience in attacking certain problems of disability which should be fully utilized in future efforts to expand and improve rehabilitation services. As only one instance, the pioneering efforts of the American Heart Association in promoting cardiac-in-industry programs and establishing work classification units in cardiovascular clinics or rehabilitation centers offer many potentialities for coordinated services to workers with heart disease.

Throughout the history of rehabilitation in this country—

the private agencies' contributions to rehabilitation are very outstanding * * *. Dr. Sabin mentioned Mr. Milbank's support of the early research in polio. Mr.

Milbank was one of the earliest supporters of the rehabilitation work. It was through his support that Colonel Smith's institute in New York (Institute for the Crippled and Disabled) was begun, which did such an outstanding job between World War I and World War II and is still doing it * * *. We have only two rehabilitation centers supported by the public program. One is in Virginia, at Fishersville, and one is at Okmulgee, Okla. The rest of the rehabilitation centers and so-called curative workshops are usually community operated, supported by a variety of community organizations, usually local philanthropies. * * * Most of the service that has to be purchased or provided, in common with hospital services the country over, is provided by nonpublic institutions. There are very few public institutions that have adequate rehabilitation centers. A little start was made at Gallinger; and Bellevue, in New York City, is famous for its rehabilitation center. (Source: Miss Mary E. Switzer, director, Office of Vocational Rehabilitation, pt. 3, p. 819.)

Many voluntary agencies, too, have a network of State and local chapters or affiliates which have united with governmental efforts to assess needs for rehabilitation and to develop additional needed services and facilities. The local crippled children's (Easter Seal) societies, local cerebral palsy associations, and local tuberculosis associations have been especially active in many localities in community planning for the disabled and the extension of services to new categories of disabled persons.

In this fight against cerebral palsy there are now extensive provisions being made for much-needed diagnosis, treatment, care, education, and other assistance for as many as possible of the cerebral palsied * * *. Today United Cerebral Palsy affiliates around the country are working diligently on such programs of assistance * * *. However, we know that this helping of the individual cerebral palsied, important as it is, will not solve the real problem. It is obvious that the eventual conquest will come in the same manner that has proved successful with our health foes—organized research to discover, first the cause or the causes; second, better methods of technique of treatment; third, probably, possible, or even partial preventives, palliatives, remedial procedures, and perhaps some day a cure for some types of damage.

This is a mammoth undertaking, much too big to be financed by any local affiliate or group or single national voluntory organization. To be at all effective, however, it must be pursued on the national level * * *. (Source: Dr. Glidden L. Brooks, medical director, United Cerebral Palsy Association, pt. 4, pp. 914–15.)

The reciprocal effect of public and private funds on the adequacy of support of a program was strikingly brought out in the health inquiry:

* * * Somehow the expenditure of public funds in research and training is always followed by a greater response from the public itself. (Source: Mrs. Ruth McCormick Tankersley, president, The National Epilepsy League, pt. 4, p. 895).

In one significantly large category of the disabled—the mentally ill—the need for an integrated public and private effort was also stressed:

Unlike other medical fields, psychiatry has been in large part "State medicine" in this country; and it is difficult to envisage any other system for handling the bulk of the hospitalized mentally ill because of the social and catastrophic nature of mental disorders. Nevertheless, like all "State medicines" the system suffers from lack of personnel, lack of incentives, insufficient reward for accomplishment, lagging research, the (ups-and-downs) of public interest and support, and the like. Even so, great progress is being made in our mental hospitals today. But progress will proceed at a much quicker pace if we harness the total forces available, both private and public, to a better integrated effort. State and Federal governments cannot do the job by themselves. Individual community effort and resources must be brought into the picture. (Source: Daniel Blain, M. D., medical director, American Psychiatric Association, pt. 4, p. 1120.)

Rehabilitation has many intangible values that contribute materially to the strength of family relationships and to the personal dignity of every citizen of our democracy. As one witness phrased it:

> There are other benefits of rehabilitation besides the economic. The value of rehabilitation to these persons in terms of personal development and personal freedom is immeasurable. No one can place a value on ability to lift a spoon to feed oneself or to walk across a room, and these are the things that rehabilitation has meant to many disabled persons. The increased ability of handicapped individuals for self-care and employment creates a beneficial effect on the morale of the individual's entire family, his community and society as a whole. (Source: Statement of Lawrence J. Linck, executive director, National Society for Crippled Children and Adults, Inc., pt. 4, p. 1026.)

Even in cases where dollars-and-cents savings can be clearly shown as resulting from rehabilitation other beneficial effects can be observed. When a husband and father is restored to wage-earning status, he regains his status as chief breadwinner and provider for his family; while his wife, poorly prepared for outside employment, can return to her own best job, that of homemaker for the family. When a disabled youngster is trained for a job he can do, and brings home his first paycheck, who can measure his pride in being able to stand on his own feet and look forward to a normal life in which he can take his place in the community?

D. THE ACUTE AND CHRONIC NATURE OF SOME DISEASES

The management of some diseases is complicated by the fact that they have both acute and chronic phases. Contrary to a widespread general impression several infectious diseases are in this category. Rheumatic heart disease resulting from infections, and poliomyelitis are examples.

Some of the so-called purely chronic diseases, such as cancer, have their acute stages when the primary aim is to prevent death. Then follows the long process of medical, emotional, social, and economic adjustment to the chronic phase.

Because up until recent years medical and public health attention has been focused mainly on the acute phases of disease that few of our hospitals are designed and staffed to deal with long-term effects. To some extent this may also be said of the training received in the past by physicians, nurses, and public-health workers.

With the gradual conquest of many of the acute infectious diseases and the consequent growth of the chronic illness problem, it would now appear that a great deal more thought should be given to a compensating shift in medical, hospital, and public health programs. It is apparent from the major emphasis now being placed on research in the chronic illnesses, on rehabilitation, and in the adjustment of professional education that this process is already under way.

As an example of the complexity of this dual problem of acute and chronic illness reference is made to the testimony related to poliomyelitis which begins with acute illness and may go on into permanent disability.

Dr. Hart E. VanRiper of the National Foundation for Infantile Paralysis (pp. 769–774) described the efforts being expended in treating the acute effects of this disease aimed at preventing death as well as the late crippling manifestation of the disease. He further de-

scribed the foundation's efforts to develop a suitable polio vaccine for prevention of the disease (p. 775).

Miss Mary E. Switzer, Director, Office of Vocational Rehabilitation, described the Federal Government's role in rehabilitation services for polio victims and emphasized (p. 814) that the crippling results of poliomyelitis are cumulative and there would still be a large backlog of persons needing rehabilitation services even if an effective preventive vaccine were to be found in the near future.

In the adjustment to long-term incapacity, psychological problems may be superimposed on physical illness after an acute illness has been surmounted. The National Heart Institute pamphlet introduced in the inquiries (p. 57) states:

> There are many real ties between hypertension and emotional disturbances, and psychotherapy sometimes brings results as good as those obtained from any other form of treatment. In meeting this problem, the physician seeks to establish a mood of composure, self-possession, and reassurance. As a general rule he prescribes the good moderate life, individually adjusted to the patient's inner and outer needs—taking particular care to avoid unnecessary invalidism.

E. CLOSING THE GAP BETWEEN RESEARCH AND CONTROL

Recurring in the testimony of many expert witnesses was the problem of giving widespread application to new knowledge gained through medical research. The lapse between useful research findings and their application is frequently prolonged. Methods for bridging this gap naturally revolve around educational and information techniques, and a considerable part of the work of public and private health organizations is concerned with programs directed to this end. Among the methods most frequently described to the committee were refresher courses for practicing physicians, incorporation of new materials in undergraduate professional training, educational films, publications, seminars, and conferences.

A related and apparently quite important activity of these public and private organizations consists of educational programs aimed at the general public. Through these programs, extensive effort is being made to inform various special groups, and the population as a whole, of facts which people should know if they are to take advantage of new developments in the prevention and treatment of certain diseases. These programs frequently point out the early symptoms suggestive of these diseases and emphasize the importance of seeking medical attention early while the chances of cure are much greater. Among those diseases in which this aspect is stressed in public education programs are cancer, heart disease, venereal diseases, rheumatic diseases, and tuberculosis—to name just a few.

A major contribution in bridging the gap between new research findings and their application is being made by local institutions such as health departments, hospitals, medical societies, secondary schools, and by local chapters of the national voluntary health agencies. A large part of the educational activities of Federal agencies, national professional organizations and lay health organizations apparently is devoted to assisting these local interests either directly or through their State counterparts.

Education is only one part of the task of translating research findings into wide-scale practical use. Obviously, the availability to the people affected of physicians, nurses, diagnostic laboratories,

clinics, hospitals, and health departments is of major importance. For example, application of new knowledge concerning the prevention, treatment, and rehabilitation of people with mental illness depends to a large extent on achieving a very substantial increase in the number of psychiatrists, clinical psychologists, psychiatric social workers and other highly specialized personnel, and an equitable distribution of these throughout the country.

For those research findings which potentially may be applied through mass measures, extensive experimentation is sometimes required in order to work out methods for their widest possible use. Methods thus developed often must be demonstrated to local public-health workers, private physicians, dentists, industrial organizations, or citizens groups. The Public Health Service and several private health agencies have played extremely import roles in this process in the past, and it would seem that programs of this nature will become even more important in the future.

Two good examples of efforts being made by voluntary health organizations to carry research findings over into daily use are provided in the testimony of two physicians before the committee.

In the field of heart disease, Dr. Irving S. Wright clearly points out the kinds of things that are being done to put research findings into control practice:

> In order to put medical research to the use for which it is intended—helping human beings—it is necessary to narrow the gap that often exists between a scientific discovery and its actual application to save a life, to avert or lessen disability.
>
> Communications between the research scientist and the clinical physician who deals with patients are being speeded up by the American Heart Association through the development of broad professional education porgrams. These programs provide practical information and tools to physicians and closely allied professional groups such as nurses to help them deal more effectively with patients.
>
> The annual scientific sessions and special activities of the various sections and councils of the scientific council are increasingly useful in bringing practical information to the medical profession.

Dr. Wright further comments on the hope of achieving better control of heart disease as follows:

> The core of the association's educational message is the hopeful concept that something can be done about heart disease. It may be summarized in these five simple facts:
>
> (1) Some forms of heart disease can be prevented * * * a few can be cured.
>
> (2) All heart cases can be cared for best if diagnosed early.
>
> (3) Almost every heart condition can be helped by proper treatment.
>
> (4) Most heart patients can keep on working—often at the same job.
>
> (5) Your symptoms may or may not mean heart disease. Don't guess or worry. See your doctor and be sure.
>
> Broadly speaking, the health education program is a dynamic effort to change people's behavior in relation to the cardiovascular diseases, encouraging them to accept the responsibility of acting upon knowledge they receive. This action takes the form of self-help through consultation with a physician to obtain needed medical aid and of participation in community heart association programs to develop the needed facilities and services for patients with heart disease.

For the field of arthritis, Dr. McEwen mentioned the gap between the knowledge of the average practitioner and the latest available information:

> The CHAIRMAN. If you wish to answer this question in the same way, do not hesitate to do so.

Do you think the average practicing physician in this country is adequately trained to take care of an arthritic patient? That is, do we have enough specialists in this field? Do we have enough clinics? How do we compare to England in this respect?

Dr. McEwen. That is always a difficult question to answer, because you have to define what is "adequate," do you not? I would say this: That the average physician in this country, I would think, is probably as competent to take care of these problems as the physicians of most any other country. But if you think in terms of adequate care being that care which makes use of the latest information and the finest skill in it, then certainly the answer is that there are a very small number of physicians in this country who are fully skilled in these diseases.

Again, I think it depends on how you define the word "adequate." I think the average physician, yes, would give adequate care, but not the best care that could be had if he had had more experience with these particualr diseases.

F. RESPONSIBILITY FOR DISEASE CONTROL

The health inquiry amply portrays the fact that many groups of people must and are assuming responsibility for disease control. The immensity of the problem is so great that no one group could hope to assume the total burden of costs for disease control in all its aspects.

Chairman Wolverton referred to such responsibility as follows:

The Chairman. I think aside from Government itself there is a responsibility that falls not only on the organizations of a medical character, but on the people generally. Last night I addressed an organization known as the Tall Cedars of Lebanon, a Masonic order. I learned that that organization had taken upon itself a responsibility with reference to providing funds for research into muscular dystrophy in connection with the work being conducted at the New York Hospital. That opened my eyes to possibilities, when an organization such as that, not an exceedingly large organization, takes up its responsibility and endeavors to raise funds to carry on research. It is an indication of what can be done if the public generally is made to realize what the conditions are and what its responsibilities are. I think that we are moving along in that respect.

I think that all of these organizations—heart, cancer, and these represented here today—and all the various organizations that are out making their drives for funds from the public are necessarily showing the public that the need exists and what can be accomplished if the funds are provided. So I am hopeful that as a result of these hearings there will be an awakening of the public conscience; of its responsibilities and the part it should take in the carrying on of this work that will mean so much to the future happiness of our people.

The private physician has the responsibility of rendering service to the patients who seek his services, and he is in an excellent position to influence his patients with respect to improving their health practices. He can also offer or suggest procedures aimed at disease prevention. Patients as a rule, however, seek a private physician's services after the disease has struck and the immediate concern is relief of suffering. In caring for a patient the physician, of course, is obligated to furnish the best scientific procedures that are available toward protection of this patient and his family. In the case of communicable disease the physician has the further responsibility to institute such measures as are indicated to protect others in the community. No such action is possible in diseases that are not communicable, hence the vital importance of education that will lead individuals to seek help voluntarily before disease has progressed substantially.

The private physician's role is limited by the number of patients who seek his services, and since most patients have in the past sought services after illness strikes, the possibility of widespread preventive services by private physicians depends quite heavily upon not only

their efforts but also on the various health education campaigns that reach the people at large.

Health organizations, both professional and lay groups, can and do operate programs aimed at public enlightenment. The private groups that collect funds do a great deal in the health education field. This is amply brought out in the testimony throughout the health inquiry showing that grants for research, medical education and for services, where not otherwise provided, are given for these purposes. Health organizations, however, are limited in that many of them must depend on fund donations which have provided in total less than is required to do the whole job.

The efforts of the many voluntary health associations to extend both professional and general public education on health problems deserve special mention. They tell this story in various ways as follows:

American Diabetes Association (p. 532):

The organization to carry on this educational effort, under direction from the American Diabetes Association, includes 34 affiliate associations and some 850 committees on diabetes of county and State medical societies (the committees have grown in number from an original total of 27 in August 1949). In their respective localities these groups enlist the help of numerous civic clubs and organizations, together with labor, business, and school groups, in organizing and conducting community educational and testing programs which reach hundreds of thousands of citizens each year.

For these local campaigns the association provides each year tens of thousands of copies of 8 pamphlets outlining organizational methods, circulates three-quarters of a million popular educational leaflets and 35,000 posters, and provides testing material, including reagents, for about 1½ million screenings to determine whether persons examined show signs of diabetes.

Arthritis and Rheumatism Foundation (p. 496):

There are only about half a dozen medical schools in the country which have a section of their full-time and part-time faculty devoted to a broad and comprehensive program of teaching and research in rheumatic diseases. It is reasonable to assume that the teaching of rheumatic diseases in other medical schools has received little attention. In fact, the foundation has information which indicates that not more than 1 or 2 didactic lectures on arthritis have been given to the students of some medical schools in their clinical years. In others, none have been given. The foundation, through its 35 chapters scattered throughout the country, has probably done more in the last 4 years to stimulate the teaching of arthritis than has ever occurred prior to this time. Undergraduate and postgraduate seminars and lectures have been conducted by nearly all chapters in cooperation with university hospitals, medical schools, county medical societies, and State medical society meetings. In this way thousands of physicians have been reached. Some chapters have offered traineeships and clinical fellowships.

American Psychiatric Association (p. 1120):

The funds available to the American Psychiatric Association are realized from dues paid by its members and from temporary grants from various foundations and Government agencies for special projects. It is a nonprofit educational association and all of its funds are used in behalf of its stated constitutional objectives which are to further studies of the nature, causation, treatment, and care of the mentally ill; to further psychiatric education and research; to make psychiatric knowledge useful to other branches of medicine, to other sciences, and to the public welfare.

National Multiple Sclerosis Society (p. 959):

The society has become the recognized clearinghouse for information the world over on multiple sclerosis. Hundreds of letters are received from medical and nursing personnel asking our opinion on certain forms of treatment and other information.

A medical manual containing information on current developments in multiple sclerosis has been published. This manual, which is revised periodically, is distributed to 28,000 physicians on our medical mailing list and to all other interested physicians.

To reach the nursing profession, a reprint of an article appearing in the American Journal of Nursing, which gives guidance to nurses in the care of multiple sclerotics, has been distributed to interested nurses.

The society has organized a panel of international corresponding neurologists consisting of 56 neurologists from 27 countries. The purpose of the panel is to keep all research centers and investigators in the world posted on developments in the field.

An important function of the society is to inform some 23,000 members of its activities. A quarterly bulletin, AARMS Forward, not only informs members but also serves as a moral stimulant to patients and their friends.

Educating the public is difficult because of past neglect and public ignorance of MS, but there is great encouragement in the progress made as a result of the society's educational program. Many more people than ever before know something about MS, and its problems are being publicly discussed and studied.

National Tuberculosis Association (p. 590):

Now, what becomes of the other 94 cents which remains in the State? Thirty-two cents, or approximately $6.5 million of those $20 million, went to health education—trying to teach and talk to and advise and urge the public after they have been informed of the dangers of tuberculosis, and the chances of curing it. That has taken time. The rest of its goes to arouse the public to the point where they will see to it that proper facilities are provided—beds for the sick in hospitals and better living conditions, better hygiene, and all those things which go to make up a more healthy public, which, in turn, would give an added resistance to the incidence of the disease.

Each of the other voluntary health agencies emphasized the part they play in furthering scientific knowledge, both professional and general. All known media are used for this purpose, radio professional journals, the press, exhibits, movies, etc.

That these organizations have succeeded in their efforts is evidenced not only by response to the fund drives, but also by the degree to which communities and governments have increased their activities. Throughout the hearings there was evident a healthy atmosphere of cooperation among related health organizations and Government.

In the past few years employee unions have taken an increasing interest in disease-control programs. The testimony reveals this in connection with the poliomyelitis discussion and rehabilitation services (pp. 819–820). Unfortunately only the larger employee groups can afford this type of program and even then the health services are largely limited to the employees and do not provide for the total family and community in many instances.

Local governments vary considerably in their efforts at disease control. The more densely populated areas and larger urban areas expend considerable money and effort in prevention, case finding, treatment, and to some extent rehabilitation services. Most of these programs are supplemented to some extent by State and Federal funds as well as funds from voluntary health groups. Smaller communities must depend considerably on assistance from funds and facilities from outside sources.

State governments also vary considerably in their disease-control programs. All render some financial assistance to most critical areas in their jurisdiction. There are many States that also provide statewide facilities for treatment and control of tuberculosis and hospitals for the treatment of mental disease. The testimony pointed out, however, that many State hospitals for mental patients were so

crowded and the problem of manpower was such that little or no effort is being expended in prevention and research that would lead to control and prevention. The poorer States are somewhat limited in funds to carry on extensive disease-control programs, and too frequently such States have the largest disease problems.

The Federal Government through its grant-in-aid program has assisted States in their disease programs in accordance with their disease problem and their financial need. The health inquiry testimony states at considerable length the degree to which this is being done in the control of cancer, mental illness, tuberculosis, poliomyelitis, heart disease, and diabetes as well as rehabilitation services. The Federal Government is also carrying on extensive research within its own facilities and by making grants to States and institutions.

In the field of disease control the Federal Government is filling its traditional role of providing disease-control assistance for diseases that are of national concern and supplying needs that are not otherwise being met. The testimony points out that the Federal Government cannot be expected to meet all the demands placed on it. As the chairman pointed out, the people have responsibility other than through Government to assist in the control of disease.

G. EXISTING NEEDS IN DISEASE CONTROL ACTIVITIES

Throughout the health inquiry, the shortage of manpower in the specialized fields was emphasized. The reasons for the manpower shortage appear to be many. Dr. F. M. Forster stated one as follows:

I wonder, Mr. Chairman, if I might for a moment put on my other coat.

The matter of the medical schools was brought up several times. Speaking now as a dean, I think I might be able to give you some information you may like to know.

Obviously you wonder why the universities, which we have long looked to as the citadels of knowledge, are not forthcoming in backing research. This is not only true for this institute but for all institutes.

I would like, in case you are not aware of the plight of the medical schools, to say that at the present time the tuition range in medical schools in most areas is somewhere in the neighborhood of $900 per year per student, which we think is terrific, really, but the cost of educating that student in the medical school averages, across the country, around $3,300 per year. Therefore, we in the medical schools are operating at a loss.

The private philanthropic funds are no longer available, or to a very limited degree, so that the medical schools have that particular plight.

Actually, I happen to be more fortunate than most of my colleagues because the rector of our university understands what we are doing. For most of the deans of medical schools one of the chief jobs is to sell the president of the university on the idea of not letting go of the medical school, because they look at it as the hole in the bucket of the finances of the university, and they feel that the medical school is siphoning out the funds of the whole university.

If you do not mind that parenthetic interjection, sir, I think that is the situation in the medical schools.

Mrs. Ruth McCormick Tankersley states the problem as follows:

I would like to make 1 or 2 sort of disconnected remarks just as an augmentation to the things that have been said about epilepsy.

First, I would like to underline, from my point of view, as president of the National Epilepsy League, the tremendous need for more qualified doctors, more men trained. Every year my agency gets about 25,000 to 50,000 letters from epileptics who are receiving totally inadequate medical care, asking us where to send them. We have nothing whatever to say to them. There is not any place we can send them. There are not competent doctors and big enough clinics and enough clinics for us to send these people to. It is the most terribly disheartening

feeling to run an agency and to have these people coming to you for help and having practically no place to send them, and their family doctor, who cannot keep up with everything is not up on the medicines that will control epilepsy.

So our biggest problem in epilepsy is that we can control 80 percent of these people if we can only get them a doctor and get them good medical care.

Dr. Lorand Johnson states still another viewpoint as to shortages of teachers in certain fields:

May I cite as an example, that the entire State of Ohio has no ophthalmic institute. Nearest specialized facilities are at Chicago or Philadelphia or in the near future at Toronto, Canada. It is beyond the capacity of a medical school to provide such facilities for an entire community, and it is traditional that medical centers provide only sufficient facilities for meager student-teaching purposes and not for adequate resident training or for prevention or rehabilitation.

The problem of enough money was in the mind of most witnesses but at least one witness testified that more money could not be properly spent without adequately trained personnel. This would seem to indicate that more of the existing money should be used for training purposes which would put greater emphasis on control of disease. This point was made especially strongly in the field of mental illnesses.

The need for more knowledge as to causes and methods of disease control was amply expressed in connection with all of the diseases under consideration. Testimony was not in the form of a complaint as to the lack of money for this purpose, but rather as a plea for an appreciation that continuous study and research in the direction we are now going must be carried on. Dr. Cornelius Traeger expressed it as follows:

At this point I would like to take a moment to talk about the Clinical Center at Bethesda. In the new Clinical Center at Bethesda, the Institute's research program is geared to finding improved methods of diagnosis, prevention, and treatment and rehabilitation of neurological and sensory disorders, with special reference to epilepsy, cerebral palsy, multiple sclerosis, muscular dystrophy, glaucoma, cataract, and so on. The potential facilities of the Bethesda program provide a unique opportunity for the first telling attack on these crippling disorders.

In the field of mental and neurological diseases there is ample testimony that greater knowledge and interest is needed so that appropriate control or preventive measures may be found.

The fact that many millions of dollars are being spent on research by many groups emphasizes the urgency of establishing patterns of coordination and communication which will assure that research findings are put to prompt use in control and corrective programs. Such factors as manpower shortages, as expressed throughout the hearings, appear to be a deterrent to putting research work into action, but the view that there was excellent communications of scientific findings to those concerned was expressed by Dr. William McHammon as follows:

I would like to answer that, in part with something I was going to voluntarily supplement Dr. Haas' report with. As an outsider from the Public Health Service, I think a medium of the Public Health Service has been the published reports, such as the Public Health Reports. This publication has been an excellent source of dissemination of scientific knowledge, not only on research in the Public Health Service laboratories, but research done in the university laboratories. I think that needs emphasis here. Public Health Reports has served an excellent function in disseminating information regard scientific research. The number of journals in this country where one can publish these reports—and unless they are published they are of no particular use to anyone else—is limited. The length of the articles is greatly limited—the amount of detail that you can

put in. Public Health Reports is a medium of publication and an important one, and I would say that some very classic and some very important reports on polio have appeared in that journal.

The significant increase in medical research in recent years raises the question as to how comparable emphasis can be placed on disease control and the application of research findings. It is noted in this connection, for example, that while funds are being provided by the Federal Government for research in arthritis and neurology, there is no special provision for control measures in these fields.

As our stockpile of research knowledge grows, it becomes even more important that steps be considered for the proper utilization of research findings wherever applicable to the control of disease. The mere possession of knowledge is of little value unless it can be put to work. New scientific findings in themselves are exciting advances, but the expansion of research should be accompanied by the development of disease-control procedures. Both need to be carried on toward the ultimate goal of disease control and disease eradication.

The Congress has wisely recognized the value of proper utilization of research findings. In the field of communicable disease, funds have been provided for the application of knowledge to disease control. Through its Bureau of State Services, the Public Health Service has developed an effective program of control services. Working cooperatively with State and local health groups, and with voluntary and professional organizations, it has contributed in no small measure to the virtual eradication of such diseases as malaria, yellow fever, smallpox, and diphtheria and today such diseases as VD and tuberculosis are being attacked in the same way.

This coordination and utilization of research findings must continue in all phases of the Nation's health activity—prevention, treatment, rehabilitation—if the primary goal of the health inquiry—better health for more Americans—is to be achieved.

The American Cancer Society dramatically states the value of public education as a factor in motivation, as follows (p. 230):

> Of the 220,000 people who died of cancer in 1952, 70,000 could have been saved if they had received treatment in time. We must keep everlastingly at it. Education, thought, care, are of the essence. With present knowledge alone, and use of precision methods, if people would see their doctors upon the first appearance of a sign which may mean cancer, about twice as many people could be saved from the disease as are being saved at present. The signs which may mean cancer are—
>
> 1. Any sore which does not heal.
> 2. A lump or thickening, in the breast or elsewhere.
> 3. Unusual bleeding or discharge.
> 4. Any change in a wart or mole.
> 5. Persistent hoarseness or cough.
> 6. Persistent indigestion or difficulty in swallowing.
> 7. Any change in normal bowel habits.
>
> But knowing the signs is not enough. People should know that if untreated the disease will spread and once that happens there is little hope of cure. They should know the examinations which may be made at home or by the doctor to help detect certain forms of the disease, as breast cancer, cancer of the cervix, and lung cancer. They should know that only surgery, X-ray, and radium can actually cure cancer and only when treatment is early—that quack treatments cost lives. Moreover, people are persistently interested in research: What have we learned about cancer that we did not know a few years ago? Has a new and certain test for cancer been discovered? A new cure?

Part II

Progress and Goals in Fighting Disease

NOTE.—In the remaining chapters of this preliminary report, the testimony of the witnesses is assembled according to disease category. Each chapter begins with a brief summary and each follows the same general outline, so that it is easy for the reader to pick out any portion of the subject in which he is particularly interested.

For the sake of simplicity and brevity, the material which follows is not presented with the liberal use of quotes that characterized the first three chapters. However, all of the conclusions and all of the data are drawn from the four volumes of testimony upon which this preliminary report is based; and since they, too, are broken down by disease category, it is a simple matter to go to them for substantiation or elaboration on any point.

CHAPTER IV

HEART DISEASE

A. SUMMARY

The information brought forth by the committee's inquiry on heart disease reveals that much is being done in research and its application against our leading killer and that even greater progress can be achieved.

A digest of this information follows. It shows that heart disease is a large group of diseases of the heart and blood vessels, which cause over half of all the deaths in the United States each year and which impose a staggering burden in suffering and in economic losses to the individual, the family, the community, and the Nation as a whole.

It shows the nature, scope, and direction of the current efforts against heart disease and that they represent a cooperative, nationwide mobilization of resources, both private and public, with developing activities in research, education, and community and public health services.

It shows some of the progress that has been achieved in recent years, a great advance in knowledge against the whole complex range of heart disease.

It shows, too, that while healthy and progressing, the national heart effort is, like all human endeavor, not perfect, and has room for improvement. Heartening is the fact that gaps and obstacles are recognized and that positive suggestions for overcoming them are made.

It shows, lastly, that the seeking out of the now unknown, underlying factors behind rheumatic, hypertensive, and coronary heart disease—which account for over 90 percent of all heart deaths—is para-

mount if we are to reach the desired goal: the virtual elimination of *untimely* heart disease death and disability. It indicates that this goal is attainable in our time.

The digest, thus, serves as a basis for understanding and action toward the conquest of the heart disease problem. It is highly instructive, interesting, and challenging.

B. WHAT IS HEART DISEASE

Heart disease is the popular name for a large group of diseases referred to by physicians as cardiovascular diseases. These include diseases of the heart and of the vast network of vessels through which the heart pumps blood to and from all parts of the body. The heart and blood vessels make up one great system, the circulatory or cardiovascular system.

This cardiovascular system is the transportation system of the body—it corresponds to the railroads, navigable rivers, airlines, highways, streets, and alleys of a nation or a continent. The heart supplies the power for the transportation system.

By way of this intricate transportation system everything that is needed by the cells and tissues and organs of the body is delivered, useful products are picked up and distributed, and waste material and refuse are hauled away for disposal. It is comparable to a system whereby coal and groceries are delivered to homes, and the ashes and garbage are carried away, raw materials are delivered to factories and the finished products are distributed to warehouses, stores, and consumers.

If anything happens to tie up the transportation of a great city, work in all the factories and shops slows down, all the homes run short of food, fuel, and other necessities, and garbage and refuse of all kinds pile up; the life of the city is disrupted. Similarly, if anything interferes with the efficient working of the human heart and the normal flow of blood through the vessels, the individual in whom this occurs is sick—he has one of the many kinds of heart disease.

Heart disease occurs when the heart's own blood supply is insufficient, when the heart is called upon to do more work than it is capable of performing, or when the heart becomes damaged and is unable to do its normal work efficiently.

In addition to diseases which affect the cardiovascular system as a whole, there are diseases of the blood vessels which affect the circulation in localized areas—peripheral vascular diseases, some of them closely related to some kinds of heart disease.

There are a score or more causes of heart disease.

Many kinds of heart disease—actually most of them—are not primarily diseases of the cardiovascular system itself, but are caused by disorders which have various effects upon the heart and blood vessels.

Little realized is the fact that the causes of many kinds of heart disease are known, and that they therefore can be prevented or cured. This was not always so; but as medical research has advanced during recent decades, the list of preventable and curable heart disease has grown, one by one. As each new disease has been added to the curable list, it has become minor because it no longer causes much disability or death.

The many causes of heart disease affect the cardiovascular system in various ways.

Some of the causes of heart disease make the heart pump more and more blood, faster and faster, until finally the heart is unable to keep up with the excessive demands made upon it. Others cause an increase in the resistance to the flow of blood, making it necessary for the heart to work harder to overcome the resistance.

Some causes of heart disease result in damage to the valves of the heart. The valves may become incapable of closing completely, thus permitting blood to flow back into the chambers of the heart and accumulate there; or the valves may become narrowed, not opening fully when they should, making it difficult for the heart to pump blood along its course.

Damage to the valves of the heart is often associated with damage to the lining of the heart, and both the damaged valves and lining may become infected with bacteria; little particles of infected clot-like material may break off from the infected areas and be carried along in the blood stream to other parts of the body.

Sometimes the sack which covers the heart becomes infected, and fluid collects in this sack, causing pressure upon the outer walls of the heart and making it impossible for the chambers of the heart to fill adequately; or the space between the heart and its sack may become obliterated by hard, calcified material which constricts the action of the heart muscle.

Often the heart muscle itself is damaged by micropathogens or by toxic substances. Part of the heart muscle may become injured and replaced by scar tissue if the blood supply to an area of the heart is cut off by occlusion of one of the arteries supplying the heart with blood.

In many of the conditions described there is an increased strain on the heart; this often causes the walls of one or more of the chambers of the heart to stretch, enlarging the cavity. In response to the increased strain and the increased amount of blood in the enlarged cavity the muscular walls of the heart may thicken. Enlargement of the heart results from one or both of these changes.

In many kinds of heart disease the normal, regular rhythm of the heart beat is altered; the heart may beat excessively fast, abnormally slow, or quite irregularly. Such abnormal rhythms reduce the efficiency of the heart.

Practically all of these conditions described, if not corrected, may lead ultimately to heart failure—the heart can no longer do the work required of it—the body's great transportation system is stalled. When the heart fails, the chambers of the heart do not empty, the supply of blood carrying oxygen and other needed materials to the tissues is reduced; the return flow of blood to the heart and lungs is slowed down, the veins becomes distended; fluid accumulates in the tissues of the lungs and of the peripheral parts of the body; the patient becomes short of breath and swollen with edema; function of various organs is impaired, including the kidneys which retain sodium and water thereby increasing the edema.

Although prevention of heart disease, or cure, by getting at the cause is the ideal, this as yet is not always possible. Even when prevention and cure is not possible, research has provided many ways in which many abnormal heart conditions can be corrected or alleviated.

Damaged valves often can be repaired by new surgical methods. Infections of the heart, its covering sack, its lining, or of damaged valves can be prevented or cured by new antibiotics. Calcified tissues constricting the heart can be removed surgically. Abnormalities of the rhythm of the heart beat can be prevented or corrected by new drugs. The failing heart can be strengthened by digitalis and related drugs, edema eliminated by new drugs which help the kidneys to rid the body of excess sodium and water or prevent the absorption of sodium present in food, and abnormal clot formation can be prevented by new drugs known as anticoagulants. All of these accomplishments are largely result of research.

A description of some of the various causes of heart disease follows:

The "minor" heart diseases

Anemia.—The amount of oxygen in the blood is reduced in anemia. In an effort to meet the oxygen needs of the tissues, the heart pumps more blood at a faster rate. This increases the work of the heart, and, at the same time, the oxygen need of the heart itself; but because of the anemia, the blood reaching the heart muscle actually supplies less oxygen. Unless the anemia is corrected heart failure may occur. Fortunately, as a result of research, most of the common causes of anemia can be corrected, and heart disease caused by anemia can be prevented or cured.

Thiamin deficiency.—Deficiency of thiamin (vitamin B_1), which occurs in some forms of malnutrition, and often follows chronic alcoholism, may cause heart failure. In this condition the heart pumps more blood, at a faster rate, possibly in an effort to compensate for defective oxygen utilization by the tissues as a result of the vitamin deficiency. This is another kind of heart disease which is preventable and curable—as a result of information gained from many kinds of research, conducted over decades by many research workers in many different fields of scientific investigation.

Hyperthyroidism.—An overactive thyroid gland speeds up the fuel consumption of the body. This requires increased oxygen in the tissues. To supply the extra oxygen demand the heart has to pump more blood at a faster rate. As a result of this extra demand on the heart it may beat too rapidly or irregularly, it may enlarge, or it may fail. Heart disease caused by hyperthyrodism can be cured by correcting the overactivity of the thyroid; this can be done effectively by surgical and medical treatment. Research, including the use of radioactive iodine, has made possible improvements in both diagnosis and treatment of hyperthyroidism.

Hypothyroidism.—An underactive thyroid slows down virtually all the life processes, including the action of the heart which may become sluggish, enlarged, or may fail. The exact mechanism by which thyroid insufficiency causes these effects on the heart is not known, but they usually clear up when the hypothyroidism is treated by administration of thyroid extract.

Syphilis.—The spirochete that causes syphilis can damage the wall of the aorta, the great vessel through which the heart pumps fresh oxygenated blood destined to go to all parts of the body. This damage may be accompanied by great enlargement and sometimes ultimate bursting of the weakened aortic wall, by insufficiency of the aortic valve, and by narrowing or obstruction of the mouths of the

arteries which go to the heart itself from the aorta. Rarely, it may directly affect the heart muscle itself. As a result of research, the cause of syphilis is known, and as a result of research it can be treated and prevented with antibiotics.

Cardiovascular syphilis is one of the great outstanding examples of a major cause of heart disease which is being reduced, as a result of research, to almost a minor cause, which seems destined ultimately to become even a rare cause.

Bacterial infection.—The heart, its valves, and the tissues that cover it and line its chambers may become infected by various bacteria. Formerly, bacterial infections associated with heart disease were more common and more frequently fatal than during recent years. Again, medical research, especially in connection with the antibiotics and chemotherapy, has made it possible to prevent and treat effectively a large proportion of cases of another kind of heart disease.

Other infections.—Almost any acute infection may worsen existing heart disease, and some infections, including rickettsial infections, and viral infections such as poliomyelitis, may cause severe heart damage. Such cases are uncommon, and research on the infectious diseases may lead to making them even more rare. Many years ago diphtheria was fairly common; it caused many deaths, a larger number of them from poisoning of the heart by the toxin of the diphtheria bacillus. Such deaths are rare today because of the widespread application of information gained from research which made possible the prevention of diphtheria by immunization, and successful treatment of it by antitoxin.

Other etiological factors.—Chronic nephritis, diabetes, obesity, and gout are among the other conditions with which heart disease may be associated, frequently along with arteriosclerosis or hypertension. Obesity can be prevented or corrected; diabetes can be controlled. In some instances these conditions can be prevented, alleviated, or cured, and research holds much promise for the future.

Congenital heart disease.—A few out of every thousand infants are born with some kind of congenital cardiovascular defect. There are many possibilities for something to go wrong during the embryological development of the heart from a simple tube to a remarkably efficient pump. There are 35 recognized congenital abnormalities of the heart and great vessels. Some of these are virtually incompatible with life, some cause no demonstrable impairment of normal health, others range all the way between these two extremes; some are extremely rare, others more common.

Little more than a decade ago there was no known treatment for any of them. Today, as a result of research, some of these congenital defects can be corrected completely by surgery, others can be improved greatly, and research is in progress on surgical procedures which may prove beneficial to still others. The congenital defects for which there are neither already existing surgical treatment, nor the hope for such treatment, are relatively rare.

Along with methods for treating congenital defects, there have been improvements in methods of diagnosing them, so that they can be brought to treatment.

Equally important is the fact that research is discovering some of the causes of congenital cardiovascular malformations; these include

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prenatal infections of mothers, particularly viral infections, vitamin deficiencies, radiation, and metabolic and endocrine disorders. As knowledge of the cause increases, prevention becomes more widely possible.

Trauma.—The heart, the sack which covers it, and the great vessels leading to and from the heart may become damaged by chest injuries, including penetrating wounds, severe blows, and crushing injuries. Often, if these injuries are discovered in time, the damage can be repaired by surgery. Success in such surgery has increased in recent years as a result of research making possible improved surgical techniques.

Heart disease, frequently leading to heart failure, can result also from injuries to vessels some distance from the heart, resulting in the mixture of arterial and venous blood through a fistula between a damaged artery and vein. Such injuries are fairly common in wartime. They make it necessary for the heart to pump more blood at a faster rate to compensate for the diverted flow and the mixing of arterial and venous blood. Heart disease resulting from such injuries can be prevented or cured by modern surgical methods which eliminate the fistula.

Pulmonary arterial hypertension.—Some diseases affecting the lungs make it difficult for the heart to pump blood into the lungs, and cause an increase in the pressure in the artery leading from the heart to the lungs. The extra work the heart does against this increased resistance may cause heart disease. A principal cause of acute pulmonary arterial hypertension is pulmonary embolism, which itself is usually caused by a clot going to the lungs from a leg vein: pulmonary embolism may cause death. It can be prevented by preventing or promptly treating phlebothrombosis of the leg veins which often occurs because of slowed-down circulation accompanying prolonged bed rest following surgical operations or medical diseases, including heart failure. Simple preventive measures include cleanliness and care of the feet, including treatment of fungus infections, avoiding prolonged sitting especially with constricting garments, exercise of the legs of bed patients, treatment of varicose veins, use of elastic bandages or stockings, use of drugs which reduce abnormal clotting of the blood where indicated, and tying of affected leg veins if necessary. All of these measures have come into widespread use during comparatively recent years as a result of research. Much more research is needed to determine the mechanisms of normal and abnormal blood clotting.

Chronic pulmonary arterial hypertension is caused by chronic lung diseases such as emphysema and pulmonary fibrosis, and by deformities of the chest. Again, research has made, and is making possible prevention and increasingly effective treatment of these conditions.

Neurocirculatory asthenia.—This condition, also known as effort syndrome, and, in the armed forces, as soldier's heart, is characterized by a set of many symptoms which frequently accompany physical effort or emotional disturbance. In true neurocirculatory asthenia there is no actual heart disease present, but the symptoms often are related to the cardiovascular system. There is no agreement as to the cause of neurocirculatory asthenia. Although neurocirculatory asthenia causes much discomfort and some disability, it does not re-

duce life expectance. There is a great need for more research in this field.

The major heart diseases

Rheumatic heart disease.—Rheumatic fever is one of the three major causes of heart disease. Heart damage resulting from rheumatic fever is one of the most common causes of death among children and young adults. Thousands of such deaths occur each year among persons in their most promising and productive years; additional thousands of deaths occur among older persons whose hearts fail as a result of heart damage caused by rheumatic fever earlier in their lives.

Although the true cause of rheumatic fever is unknown, during recent years evidence has accumulated that it usually is preceded by infections with some types of streptococci. These are the bacteria that cause many sore throats, tonsillitis, scarlet fever, and some other diseases.

Streptococcal infections are extremely common, but fortunately only a small proportion of such infections are followed by rheumatic fever. But nevertheless, thousands of new cases of rheumatic fever occur each year.

Among persons with previous rheumatic fever new attacks are especially frequent after streptococcal infections, and each new attack of rheumatic fever may do further damage to the heart and its valves.

The control of rheumatic fever is now possible.

Rheumatic fever can be prevented by prompt treatment of streptococcal infections in persons who have never had rheumatic fever. New attacks of rheumatic fever can be prevented and heart damage prevented or minimized among persons who have already had the disease by long-term treatment to prevent recurrence of streptococcal infections. In both situations physicians have at their disposal an increasing number of antibiotics which are effective in eliminating or preventing streptococcal infections.

This achievement, the development of a means of preventing rheumatic fever, is an outstanding accomplishment of laboratory and clinical research and is a landmark among recent achievements in the control of heart disease.

Arteriosclerosis and hypertension often occur together, and together they combine to constitute the major unsolved problems of cardiovascular disease. This is so because neither their cause nor their cure is known.

Hypertension.—When the heart muscle contracts it must send the blood along its course with sufficient force to overcome the resistance in the arteries to the flow of blood. This creates pressure within the arteries which doctors can measure with a blood pressure apparatus known as the sphygmomanometer .

Through a system of nervous and chemical mechanisms it is possible for the very small arteries and their even smaller branches, the arterioles, throughout the body to constrict, or become smaller, or to dilate, or become larger. This makes possible alteration in the amount of blood flowing to different parts of the body in accordance with the need at any given time.

If most or all of the small terminal branches of the arteries constrict, this increases the resistance to the flow of blood, and when this happens, the heart muscle must contract with greater force to send

the blood along against the increased resistance. This increases the pressure of the blood in the arteries.

The way in which high blood pressure causes heart disease is quite simple: The increased peripheral resistance resulting from constriction of the very small arteries and their branches makes it necessary for the heart to work much harder to maintain a normal flow of blood against the resistance. If the blood pressure remains high enough for a long enough time the hard-working heart ultimately is unable to do the extra work demanded of it, and heart failure may follow. Persistent high blood pressure also may cause hemorrhage of the blood vessels of the brain, resulting in a stroke; the increased work of the heart increases the heart's own need for blood, a need which is not readily met, and which may cause angina pectoris, and, along with narrowing of the arteries accompanied by atherosclerosis, may cause heart attacks; kidney disease also is a common complication of hypertension.

There are about a score or two of conditions which cause high blood pressure. Many of these can be prevented or corrected by medical or surgical treatment—again the result of many years of laboratory and clinical research investigations.

But these various known causes account for only about 5 percent of all cases of high blood pressure; the cause of the other 95 percent is unknown. This kind of high blood pressure is called essential hypertension. Alone it causes about 13 percent of all deaths attributable to cardiovascular disease, and in combination with arteriosclerosis which frequently accompanies it, it causes an additional 30 percent of cardiovascular deaths. (This is in addition to the 48 percent of all cardiovascular deaths caused by arteriosclerosis alone.)

Much promising research is underway to determine the cause of hypertension. Under investigation are the roles of various nervous mechanisms, kidney conditions, and substances produced by endocrine glands and other tissues of the body.

When the causes of hypertension are discovered the prospect of preventing or curing the disease will be in sight. But already research has revealed much information which makes it possible for doctors to lessen the severity of hypertension in many patients by medical and surgical means, and even more effective similar methods are being developed.

Arteriosclerosis.—Hardening of the arteries (arteriosclerosis) is a term which includes several kinds of hardening. One of these, simple decrease in elasticity of the arteries with advancing age, is ordinarily not a cause of serious cardiovascular disease.

The hardening of the arteries known as *atherosclerosis*, however, is one of the most important unsolved problems in medicine. Its cause is not known and its treatment is not known. But its effects are known—it is a great killer and disabler, it causes one-half of all cardiovascular disease deaths, and one-fourth of all deaths that occur from all causes. It causes most of the "strokes," most of the heart attacks, and most of the mental disturbances among older persons. Other diseases that follow or accompany atherosclerosis include high blood pressure, kidney disease, and much peripheral vascular disease.

Atherosclerosis does its greatest damage to the vessels of the brain, the heart, and the kidneys.

Briefly, this is how atherosclerosis makes trouble: The normal artery has a smooth, even inner lining through which blood flows freely. Atherosclerosis interferes with this free flow of blood. It begins with minute accumulations of fat-like substances (lipids), mostly cholesterol, just under the surface of the inner layer, and increased fibrous thickening of small areas of the same inner layer. These small areas of accumulated lipids and thickening may enlarge and several may merge to form larger areas. These areas degenerate, form cavities filled with fat-like and calcified material, roughen the inner wall of the artery, and extend to the middle layer of the artery wall. All these changes narrow the artery, completely obstruct it, or favor the formation of obstructing clots. The result is the decrease or stoppage of the blood supply to the organ or tissues supplied by the atherosclerotic artery. When the blood supply to important areas of the brain, heart, or other vital organs stops there is impairment of important life processes, and, too frequently, death.

At the present state of knowledge, no prevention, no cure, and very little treatment is possible. But several very promising clues have been discovered as a result of the extensive research being conducted on the problem in a large number of laboratories and clinics, and there is good reason to believe that continued research will make possible the control of atherosclerosis—just as it has many other kinds of cardiovascular disease.

C. THE HUMAN AND ECONOMIC BURDEN

One of the most striking consequences of recent advances in medicine is the shift from the acute communicable diseases to heart and blood vessel (cardiovascular) diseases—which fall under the commonly used term, heart disease—as the principal cause of death.

Twenty years ago, less than a third of all deaths were attributable to heart disease, 420,000 out of 1,342,000 in 1933. Today, more than half of all deaths are attributable to heart disease, 771,000 out of 1,494,000 in 1952. As our population grows still older through the saving of life at younger ages, it is safe to predict that the proportion of all deaths attributable to heart disease will rise even higher.

It would be wrong to assume, however, that heart disease is a problem only of the aged population. This is borne out by the United States statistics for 1952 which show that of all persons dying of heart disease, almost a third (31.7 percent) die at ages under 65.

Half of the males (white) who die in their forties and fifties now die of the various forms of heart disease.

Rheumatic heart disease among children is, happily, being brought under control, and now ranks third behind accidents and cancer as a cause of death in the ages of 5 to 14. At these ages it still remains however, more important as a cause of death than any of the communicable diseases.

Good data on the prevalence of heart disease are not available. But it seems reasonable to accept an estimate that in 1949 there were not less than 9,200,000 persons suffering from some form of heart disease.

Here are some further facts which are staggering to the imagination, but nevertheless represent the picture as heart disease affects our country.

In the first place, heart disease is the leading cause of death in the United States.

It is a leading cause of death among children.

It is generally thought of as being a disease which primarily affects the aged and perhaps in some persons' minds is considered inevitable. This is a misconception, although it does affect a very large number of people as they grow older.

It causes about one-sixth of all the deaths in the "military" ages; that is, between 20 and 39.

It causes one-third of all the deaths in the most productive years, 35 to 54.

It causes half of all the deaths in the ages between 55 and 74, and it causes far more than half of all the deaths after the age of 74.

Now, in terms of manpower, about 3½ percent of all the World War II selective-service registrants examined were rejected because of heart disease.

Three hundred and seventeen thousand, five hundred men were rejected as of August 1, 1945, because of heart disease.

About 80,000 men were given disability discharges from military service or died in service because of heart disease in the war years between 1942 and 1945.

It is readily understood that this involved younger men in the so-called prime of their physical life.

Rheumatic fever alone immobilized more than 40,000 men in the Armed Forces during World War II.

Rejections from military service for heart disease were high during the Korean conflict also.

In 1 area in 1 State it was found that 1 out of every 8 men rejected, all under 26 years of age, were turned away because of organic heart disease.

In the Navy alone, in World War II, 4 million man-days were lost because of rheumatic fever and rheumatic heart disease.

The actual or potential manpower contribution—to defense or the Nation's general productiveness of 1 person out of 15 or 16 is limited to some degree because he or she has heart disease.

Approximately 176 million workdays are lost yearly because of heart disease.

At least 653,000 man-years are lost each year in industry alone because of heart-disease disabilities.

It is estimated that in 1951 about $2,124 million was the cost of heart disease in loss of productivity.

Compensation and pension payments to veterans in 1950 because of heart-disease disabilities were $168,250,000.

The proportion of insurance claim payments for deaths from heart disease has been steadily rising. In 1951 a major company paid the beneficiaries on account of heart disease a total of $173,680,000. This is just one company. This sum was about 3½ times the amount paid for the same disease in 1931, showing a very marked increase in the disability cost of these diseases.

At a hospital rate of $12 a day, according to an estimate and example, 1 patient with chronic heart disease costs about $4,300 a year to maintain in a hospital. This would mean that if 50,000 patients—and that is not an excessive number—with heart disease received hos-

pital care for a year, the cost would, in 1 year, equal $219 million for the hospital care of these patients.

Sixteen thousand dollars per case, or a total of $640 million, was the cost of the cases of the 40,000 men inactivated by rheumatic fever alone during the World War period.

Now, this is a small indication of the importance of heart-disease disability: The Bureau of Public Assistance of the Social Security Administration, Department of Health, Education, and Welfare, after a cross-section survey of 13,200 of 93,359 recipients of aid under its program for the permanently and totally disabled in the productive age bracket between 18 and 65 years reported very recently that diseases of the heart were found more frequently than any other group of diseases or impairments.

Cardiovascular disease accounted for the major or secondary impairment in over 42 percent of the recipients, and was the major impairment in 37 percent. Almost 71 percent of the recipients with a disease of the heart were aged 55 or over. Over one-fourth, however, were in the age bracket between 35 and 54.

For about 1 in every 4 of the recipients with heart disease the impairment was of 10 years or more duration. In other words, these diseases are long-term diseases, very frequently at an enormous economic and sociological cost to a community.

It is worthwhile at this point briefly to show what happens to a family; just a reminder as to what may happen to an individual and a family when one of its members is stricken with heart disease.

For instance, if a man in the productive years of his life with perhaps three children in college, having had a reasonably good earning capacity, is suddenly incapacitated because of one or another of these diseases, it produces in most families a catastrophic situation. The children often have to be taken out of college. The economic stability and social relations of the family are disrupted. The man is lost from his productive years in business, frequently. Instead of being a producer, an earner, and taxpayer, he becomes not infrequently the recipient of aid and support from others, by compulsion. This is reflected in the entire economy of a community or a country when it is realized that approximately 1 million people in this country have suffered from hemiplegia, paralysis from a stroke; and that some 9 million to 10 million people have heart disease.

Fortunately that picture does not hold for a considerable proportion of individuals who have either a heart disease or a stroke. Many of them are able to return to livelihood, but frequently they are markedly handicapped in their productivity.

If it is a child the family activities must from that time on center around this child in an endeavor to restore the child to reasonable health or perhaps arrange for the care of this child throughout its remaining years.

D. THE NATIONAL ATTACK ON HEART DISEASE

A great deal is being done about heart disease throughout the United States today by many individuals and many organizations, both public and private. While there is still a great deal more to be done before the goal of the conquest of heart disease is won, much more is being achieved than was being accomplished a few years ago. There is real

reason to take hope, to push on, and to strengthen still further the Nation's activities against our leading killer.

These activities are being carried on in research and in the application of knowledge by national, State, and local groups embodying thousands of workers in many, many fields. In the final analysis, their work all depends upon and can only be done because of the interest and support of the public, aware of what heart disease is and means—and what can and should be done about it.

Role of general nongovernmental agencies

Nationally, there are a number of private or voluntary organizations with interest in heart disease. Among these are foundations such as the Helen Hay Whitney Foundation which is directing its resources particularly toward research in rheumatic fever, and agencies like the Life Insurance Medical Research Fund which devotes its funds, contributed by insurance companies, to research in heart disease. Many other organizations of a wide range, from scientific and professional societies, such as the American Medical Association, to industrially and otherwise sponsored research, health, or welfare groups, such as the Commission on Chronic Illness, are also engaged, in varying degrees dependent upon their purposes and structure, against heart disease through certain aspects of research, education, or community service activities.

Similarly, there are many nongovernmental State organizations and institutions which, though not necessarily concerned only with heart disease, are also playing an important role in the prosecution of the attack. Numbered in these are all those among whose objectives are the advancement of human health and welfare. State medical societies, labor and management groups, fraternal and civic organizations, and many others comprise the spectrum.

The core of the Nation's endeavor against heart disease is, of course, in the local community. Here again many splendid private, voluntary bodies are functioning as part of a team providing services, both in research and in the application of knowledge, aimed against heart disease, a health problem from which no single community in the Nation is free and upon every one of which it imposes today a heavy burden. Hospitals, medical societies, civic clubs, and all the other interests within the community whose responsibilities are involved in its citizens' health and well-being—these and their members, from the family doctor and his professional coworkers to the Parent-Teacher Association member and others, are today devoting more effort than ever before to heart disease.

Role of general governmental agencies

Nationally, statewise, and locally, working with these nongovernmental organizations and groups whose interests are broader than heart disease, there are the public or governmental agencies which are similarly not limited to the heart problem but which are also a vital part of the total nationwide attack.

On the Federal level, these include to some degree almost every part of the executive branch of the Government and, it should be pointed out, the legislative branch. Through Congress' continuing and informed interest (particularly that of the congressional committees concerned with health legislation and appropriation, but also of the

whole Congress) appropriate Federal support and activity against heart disease, as against other health problems, is implemented.

On the State level, again, a wide range of tax-supported agencies functions for health and welfare, with the State health departments primarily charged with duties within which fall efforts against heart disease. Here, too, the legislative bodies' awareness and knowledge of the State's health problems provide on-going programs in which, varying according to the needs of the individual States, activities against heart disease are included.

On the local level the same picture is somewhat similarly repeated. In the cities and counties, health departments and other public agencies, supported by the people's representatives, furnish services and programs designed to help meet the communities' health needs, among which heart disease problems have been of growing importance.

In the whole of the Nation's efforts, however, there are, joined with the public and private interests mentioned above, a nongovernmental agency and a tax-supported agency both of whose entire purpose is the conquest of heart disease. These are the American Heart Association and the National Heart Institute of the Public Health Service, Department of Health, Education, and Welfare.

Role of the American Heart Association

The American Heart Association, with its nationwide network of affiliated and cooperating heart associations, is the only voluntary agency devoting all its efforts to the reduction of death and disability caused by the cardiovascular diseases. It constitutes a democratic and voluntarily established structure to help the physician, the heart patient, and the public combat heart disease through programs of research, education, and community service.

It is clear that decisive progress in controlling heart disease depends on acquiring new knowledge since the causes, prevention, and cure of the major heart ills are not yet known. For this reason, the program of the heart association has been based on a foundation of research.

The national research support program of the American Heart Association is a joint undertaking of the national office and affiliated State and local heart associations. The national office allocates to research at least half of its 25-percent share of the total funds raised in the annual heart fund campaigns. A substantial portion of the balance retained by affiliated heart associations and their chapters is devoted to the financing of additional scientific investigations in their respective areas as part of their own separate research programs.

The aim of the association's research policy is to help develop a climate in which research can move forward freely and continuously toward its goals. It strives to attract into the cardiovascular field the first-rate minds of skilled, imaginative scientists of proven talent and creative ability, and it tries to make it possible for them to carry on their work without restricting pressures and without becoming too heavily burdened with teaching and administrative responsibilities.

The American Heart Association has also established a form of research support unique among voluntary health organizations. This is the career investigatorship which offers lifetime support to recipients selected for exceptional creative ability in experimental work. The awards include both personal stipends and funds to cover laboratory expenses and overhead.

In order to put medical research to the use for which it is intended—helping human beings—it is necessary to narrow the gap that often exists between a scientific discovery and its actual application to save a life, to avert or lessen disability.

Communications between the research scientist and the clinical physician who deals with patients are being speeded up by the American Heart Association through the development of broad professional education programs. These programs provide practical information and tools to physicians and closely allied professional groups such as nurses to help them deal more effectively with patients.

The attitudes of press as well as public toward heart disease have been greatly influenced by the public relations policies laid down by the American Heart Association. These and the sound, growing program of public education have exerted a strong effect in arousing public interest, winning the cooperation of the various media of communication in reporting on the increasing progress made in the fight against heart and blood-vessel diseases, and developing a well-informed citizenry.

The effectiveness and success of the national heart program is measured in terms of what is accomplished in local communities for individuals suffering from heart disease.

Affiliated heart associations are engaged in furthering community programs for the prevention, care, and treatment of heart disease; in educating physicians and other professional groups and the lay public; and in establishing and maintaining high standards of medical and other services.

It is not possible in this brief account to list in detail the many different community services now being fostered by heart associations. The following are examples, suggesting important areas of work and achievement.

Since economic pressures are so immediate in most cases of cardiovascular disease, it is only natural that increasing emphasis is being placed on program-building efforts to keep the heart patient on the job or to help him adjust to a different job more suited to his capacities.

Through its cardiac-in-industry committee, the association has provided guidance and materials to stimulate the establishment of local cardiac-in-industry committees and programs by affiliated heart associations and their chapters. In every community where the need is indicated, establishment of a work classification clinic is being encouraged as the facility best able to provide many of the services required to fit the cardiac comfortably in a job.

Local cardiac-in-industry committees, established by heart associations to direct the employment and rehabilitation programs in their areas, are composed of physicians, employers, representatives of labor, and other interested agencies in the community. Besides organizing work classification units and rehabilitation facilities where needed, they are sponsoring conferences on the problems of the cardiac worker and in many ways are trying to arouse their communities to effective action.

In addition to scientific advances in the prevention of rheumatic fever through the use of antibiotic drugs, the development of community programs for rheumatic fever patients has done much to reduce the ravages of the disease and to contribute to the optimistic outlook in this field. The American Heart Association is intensifying

its efforts to develop complete programs to meet the needs of the young patients by drawing upon the various community services, agencies, and facilities that are required.

Role of the National Heart Institute

The principal Federal partner in the national undertaking against heart disease is the Public Health Service's National Heart Institute, which was established by the bipartisan National Heart Act, unanimously passed by the 80th Congress in 1948.

The Heart Institute—established as a division of the National Institutes of Health, the principal research branch of the Public Health Service—leads and coordinates the heart program of the Service. This program, financed by congressional appropriations, has two objectives: (1) to find new and better ways of preventing, diagnosing, treating, and curing heart disease and (2) to help see that what is already known is applied to reduce death, disability, and suffering caused by heart disease.

The program of research conducted by the National Heart Institute is to increase fundamental and clinical knowledge of the underlying disease processes affecting the heart and circulatory system, and toward evolving information which will permit the prevention or amelioration of these diseases. Institute research is progressing and playing an important role in the total heart research effort.

Heart disease research in universities and hospitals all over the country is being fostered and supported by the Heart Institute, through research grants. Under this program, funds are granted to individual scientists for carrying out important heart disease projects. These grants are making it possible for institutions to expand their existing heart research activities, to undertake new studies, and to conduct investigations in neglected areas in the cardiovascular field. In effect, the program is serving to enlist non-Government facilities and scientists in the research attack.

The stimulation given by the grant program has significantly raised the level of heart research. This has brought research progress that could not otherwise have been made, since the program supports only projects for which institutional funds are not adequate. It does not take the place of support from foundations, private philanthropy, or voluntary health organizations.

Existing research laboratories are extremely crowded and the expansion of heart and blood-vessel investigations throughout the country is limited because of lack of suitable space. Some impetus was given the research attack on heart disease in 1950 through Heart Institute grants for construction of additional vitally needed research facilities in 26 institutions located in 17 States.

These grants made possible the strengthening and enlarging of a number of established research centers, as well as giving material assistance to some institutions just beginning heart research activities. No grants have been made since 1950 as funds were not available for this purpose.

There is a shortage of skilled investigators devoting their talents to the cardiovascular diseases. Also, researchers already trained in some field or fields need additional skills to increase their competency. The research fellowships program of the Institute is helping to relieve this dual scarcity by offering encouragement and assistance to some of the

most brilliant and promising minds to enter upon a research career in the heart-disease field.

The Institute's traineeship program provides a means of partly meeting the need for more clinical personnel throughout the country with especial competency in heart and blood-vessel diseases.

The program of Heart Institute teaching grants-in-aid is making it possible for medical schools to coordinate and improve their teaching of heart disease subjects and to place adequate emphasis on the cardiovascular field. Institutions are not restricted to a rigid plan in developing their teaching programs, and the funds are utilized in varying ways by different schools.

Public health activities, as well as research and training, are also of importance in the Institute program. Grants-in-aid are made to the States and Territories to assist them in developing community programs for controlling heart disease. The grants are made according to a formula based on the population and economic needs of the State. Each State is required to match each $2 of Federal money with $1 of its own money.

Grants help State and local health departments to employ and train staffs to find and refer heart-disease cases to private physicians for diagnosis and treatment; to furnish followup services in the home; to provide training opportunities to physicians and public health workers; and in other ways to aid in restoring those with heart disease to near-normal life and useful activity. Generally, State plans include provision for several of the following: Medical direction, professional and lay education, clinic improvement, public health nursing services, and medical social services.

Assistance is also given the States by providing information on technical matters relating to control. Knowledge and experience which is gained in conducting pilot studies and demonstrations is made available.

A steadily developing program of professional and public information is being carried out. Activities include the preparation and distribution of heart-disease information-education articles, leaflets, pamphlets, reports, and other publications; planning and development of audiovisual materials, exhibits, radio and television broadcasts and transcriptions; maintenance of an inquiry and reference service; and cooperation with other agencies and organizations in planning and executing informational and educational projects on diseases of the heart and blood vessels.

The total United States heart program is considered by those actively concerned as a national collaborative undertaking against heart disease, a partnership of all interests in the cardiovascular field. The National Heart Institute, the American Heart Association and its affiliates, State health departments, foundations, medical schools, universities, hospitals, scientific and professional societies, and other agencies and institutions actively concerned with heart disease have close and friendly working relationships and regular and continuing interchanges of information. This cooperation is resulting in avoidance of unnecessary duplication, in defining suitable spheres of operation, and the formulation of programs to achieve overall objectives most effectively. It is also resulting in a truly united front in the attack on heart disease.

E. PROGRESS AGAINST HEART DISEASE

The mobilizing, strengthening, and expanding of America's resources in heart research which began only a few years ago has resulted in perhaps the most promising advances seen in any of the major chronic illness fields.

Scientific publications ranging from clearly clinical reports of new or improved therapies to very fundamental reports in basic fields portray the considerable advancement of knowledge that has accrued through the programs of heart research support, public and private, although the programs have been in operation to a sizable degree hardly 5 years. A complete list of these accomplishments would show a tremendous range of basic and clinical progress along the whole frontier of heart disease.

Research has been called "guerrilla warfare against the unknown," and its forages and attacks are often remote and difficult to assess tactically. To assay the basic knowledge added in the past few years and with certainty to announce or predict its ultimate significance is not possible. Despite this "unpredictability" of many pieces of information which science must slowly but surely fit into patterns, much has been achieved which has been immediately applicable in reducing untimely death and long-term suffering from heart disease.

Minor heart diseases

Some of the greatest advances have been against the less common or "minor" heart diseases. *The fact that they are ranked today among the less important types of heart disease is evidence that they have been reduced in rank by the benefits of research and its application.* For example:

Syphilitic heart disease and aneurysm of the aorta are disappearing; new cases are rare today owing both to early diagnosis and proper treatment of the original syphilis infection and to better treatment of aortitis (involvement of the heart's great artery) when it is discovered. Twenty years ago syphilis was one of the major causes of heart disease.

Hyperthyroid heart disease or thyrotoxic heart disease is practically extinct because of early recognition and proper treatment of the condition—toxic goiter.

Subacute bacterial endocarditis, a complication of rheumatic heart disease and congenital heart disease, has been reduced within 10 years from a mortality of 99 percent to a point where it is curable in from 80 to 90 percent of all cases; the antibiotics, aided by better diagnosis and other measures evolved from research, have made this conquest possible.

Diphtheritic heart disease and fatalities from it, once far from rare, have decreased almost to the vanishing point.

Congenital heart disease

Not long ago, heart disease present at birth was considered a hopeless condition. Today there is not only some knowledge of and means for prevention, but also the march of progress in surgery is restoring to normal or nearly normal life many children who would have been marked for invalidism or death had they been born 15 or 20 years ago.

In the light of present knowledge, primary prevention centers on protecting the mother. It is based on research knowledge which has disclosed that virus infections during pregnancy (particularly German measles), vitamin deficiencies, metabolic and endocrine disturb-

ances, and radiation are possible malformation causes when present during the first 3 months of pregnancy.

Secondary prevention—involving treatment of the infant or child—is aimed against complications developing after birth including subacute bacterial endocarditis and cerebral thrombosis. The former can be prevented through prophylatic use of antibiotics prior to and following operative procedures, such as tonsillectomies and dentistry; the latter by preventing dehydration for all cyanotic (blue coloration) patients.

Treatment is the area in which much good news is being made daily in hospitals and clinics in many parts of the country. Since the first successful operation for a congenital defect in 1938, tremendous strides have been made in surgery. The "blue baby" operation, originated in 1944, has allowed many patients to live much longer and happier lives. Looking backward from 1953, it can be said that literally thousands of operations upon at least six or more of the various types of malformations have been successfully performed—and that current research in surgery and its allied sciences such as physiology are widening the potentialities still further.

Techniques have been developed and successfully used on human patients to close holes in the septum or partition which separates the two sides of the heart. Plastic buttons have been devised which, successful in animal experiments, promise to be effective for repairing imperfections in the partitions of the heart. "Deep-freeze" methods of obtaining a bloodless field during heart operations have been developed. Blood-vessel grafting, an area of remarkable development in the past few years, makes possible the remedial treatment of some congenital defects; it is now possible to graft pieces of artery of considerable length. The "mechanical" heart made medical history in 1952; several types of these machines are in advanced stages of development and with continued improvement it is anticipated that a dependable and satisfactory instrument for clinical use in a number of areas of surgery will be forthcoming.

Rheumatic heart disease

One of the most important scientific advances of recent years has been the development of effective methods of preventing rheumatic heart disease. Rheumatic heart disease can be prevented by preventing rheumatic fever. Rheumatic fever can be prevented by controlling the streptococcal illness which almost always precedes an attack. Streptococcal illness can be controlled by treatment with penicillin or sulfonamides.

Adequate and early treatment of strep infections with penicillin will prevent most first attacks of rheumatic fever. Individuals who have had an attack of rheumatic fever, and who are therefore particularly vulnerable to recurrences, can escape further attacks by taking penicillin or sulfadiazine regularly.

A national prevention campaign, in which the American Heart Association and the National Heart Institute are cooperating, has been initiated. Its objective is to prevent the disease by promoting (1) proper treatment of strep infections in all individuals, and (2) prevention of strep infections in those individuals under the age of 18 who have had rheumatic fever or St. Vitus' dance, and all of those over 18 who have had an attack within 5 years. The program

advocates that children who have had rheumatic fever continue daily prophylactic treatment at least until they reach 18, and that anyone over 18 continue treatment for at least 5 years from their last attack. If these treatment recommendations were widely followed, it is probable that in a very few years the number of new cases of rheumatic fever would be extremely low. Thus the knowledge which could mean the virtual elimination of rheumatic heart disease in the future is at hand today.

No miracle drugs have yet been found to cure rheumatic fever once it has developed, but scientists have been studying the effectiveness of hormonal agents in treating the symptoms. It has been found that salicylates such as aspirin and the drugs ACTH and cortisone are all effective in treating the acute phase of the disease, although no conclusions can yet be drawn regarding the most effective drug.

Other recent research findings have shown that a treatment which combines cortisone or ACTH with a special diet and standard therapeutic measures can prevent permanent heart damage in a high percentage of children who have suffered a single attack of carditis, and that the extension of injury can be reduced in those whose hearts have already been damaged.

Surgical research has contributed significantly to the relief of patients who develop rheumatic heart disease characterized by damaged heart valves. One of the operations now well established is reopening of the constricted mitral valve which has become scarred and narrowed. A recent study has shown that there is only a 15 percent operative risk for persons properly selected for this operation. Another brillant operation has been originated, and successfully used on human patients, whereby a plastic valve can be inserted in the main artery to prevent backflow of blood into the heart caused by an impaired aortic valve.

Hypertensive heart disease

Although there is no specific prevention or cure for essential hypertension as yet, because of research in several areas *treatment today is better than a decade ago and is improving as time goes by.* Surgery, drugs, psychotherapy, and special diets have all been used with frequently, but not uniformly, encouraging results.

A number of drugs employed today give beneficial results in certain hypertensive cases, and these therapeutic agents are being continually improved as more knowledge of the body's chemistry, the action of the drugs, and other factors are learned from research. One of the new drugs, hexamethonium, used alone or in combination with others such as hydrazinophthalazine, gives hope of effectiveness in reducing blood pressure in many patients with hypertension, including critical types.

Diet currently is considered under headings including: (1) Low salt, (2) low protein, (3) low cholesterol diet, (4) low caloric diet, and (5) rice diet. There is considerable evidence in favor of the usefulness of some of these and, though the final answers have not yet been found, promising work under way in basic and clinical fields is yielding information of value.

The low salt (sodium) diet may have beneficial effects in perhaps one-third of those with hypertension. Improvement of certain patients following the rice diet has often been marked, and at times dramatic. The rigid restriction imposed by such dietary regimens,

however, makes them difficult for patients to maintain. Investigators are now attempting to determine the biological mechanism which brings about the favorable clinical effect in the rice and other diets with the goal of evolving diets that will find greater acceptance among patients.

A recent advance in the problem of sodium retention in the body has been the development of a plastic substance, a cation exchange resin, which when taken by mouth absorbs salt in the body. This substance (though it, too, has disadvantages) will allow some patients, presently on low sodium diets, to eat normal foods, since much sodium can be eliminated from the body with the resin.

Surgical treatment, aside from removable of a definite cause of the hypertension, such as an endocrine tumor or a diseased kidney, consists principally of the nerve operation termed a sympathectomy.

Research studies are evaluating the varying types of sympathectomy to determine the degrees of removal of nerves necessary, and to develop methods for predicting in advance those patients who would benefit from the operation.

There are many real ties between hypertension and emotional disturbances, and psychotherapy sometimes brings results as good as those obtained from any other form of treatment.

The goal of research in high blood pressure is to find the underlying mechanisms. While this ultimate goal is being sought, the research itself brings data on a wide front—answers and questions that arise from the very nature of progressing investigations. The hope is strong that before too long the treatment of hypertension will be based on understandable mechanisms.

Arteriosclerotic heart disease

Investigations in arteriosclerosis have uncovered new facets of the problem that cause medical authorities no longer to shrug this disease off as "one of the indispensable penalties of living." Perhaps no other area of a medical problem has been subject to such widespread, concerted attention or worked upon so assiduously, and with such careful analytic technique. In spite of many hopeful approaches that may presage a significant "breakthrough," however, the cause of arteriosclerosis is essentially unknown.

It is a frequently expressed belief that atherosclerosis, the form of hardening of the arteries which eventuates in many coronary heart attacks, is caused by underlying metabolic defects which may themselves be primary or which may be secondary to disorders of the endocrine organs and which may be accentuated or retarded by dietary or nutritional factors.

Association of obesity with arteriosclerosis is suspected and there is research evidence pointing in that direction. In the absence of further evidence from the studies that are under way, the conclusion has been reached by many investigators and clinicians that weight reduction may improve the prognosis in atherosclerotic heart disease.

It is well known that males in their fourth decade dominate over females of this age in their susceptibility to atherosclerosis. Recent experiments have shown that estrogen administration to cholesterol-fed chicks inhibits coronary atherogenesis, suggesting further research in effects of sex hormones on the disease. This is but one of many research approaches to the disease.

An important lead that has excited much interest concerns the existence of certain constituents of blood plasma and their relationship to blood vessel damage in atherosclerosis. Utilizing the ultracentrifuge, a large instrument which whirls blood components or other study materials at a force 220,000 to 300,000 times that of gravity in order to separate them, researchers established the existence in the blood serum of man and animals of certain "abnormal" molecules of fats and proteins, now referred to as lipoproteins. Some evidence was obtained that certain of these lipoproteins have a definite relationship to the development of coronary heart disease.

Of particular interest has been the development by investigators of a "clearing factor," so-called because by its effect upon the state of fat in the blood liquid, it has the ability to clear the milky condition of the blood. Of greater significance, however, is its ability to alter that portion of fat which combines with protein in such a physical state as perhaps to foster deposit of fat in the arterial wall.

For some 10 years it has been known that the turbidity of serum, due to fat globules present after a meal, could be reduced, or cleared, by the chemical heparin or similar compounds. Study has revealed that it is not heparin itself, but an enzymelike material which can be formed from a precursor among the serum proteins, by certain tissues (heart, lung), in the presence of heparin.

Studies now underway stemming from this research may open up the possibility that a routine blood test can be developed to detect early hardening of the arteries, and may in time provide physicians with ways to counter defects in blood causing the condition.

Other areas in which research has made progress deal with the complications of atherosclerosis, such as thrombosis and occlusion, cardiac arrhythmias, cardiac enlargement, acute pulmonary edema, and cerebral atherosclerosis. For example, a powerful new drug (procaine amide) has been developed, which has the ability to abolish the irregular heart rhythms that often prove fatal in patients recovering from heart attacks and in persons under anesthesia during operations.

Anti-blood-clotting drugs have been developed which prevent the growth of blood clots, and investigations on the prophylactic values of these drugs are underway. The widespread clinical use of one of these anticoagulants, Dicumarol, was hastened by a cooperative study carried on in 16 hospitals in 10 cities under the auspices of the American Heart Association with the financial support of the Public Health Service, which showed the agent was of benefit and could save and prolong lives. The answer to a vital question was thus obtained in less than 2 years, whereas 1 team working alone would have taken perhaps an entire decade to secure the same information.

Further investigations of Dicumarol and other anticlotting agents are continuing in a number of laboratories to improve these drugs until their potentialities are completely realized. Requirements for a better anticoagulant have been set up, and work in progress is directed to the development of an agent without the disadvantage of present drugs.

Research in arteriosclerosis, upon which the energies and abilities of many investigators are focused, is developing much new knowledge which promises to be of eventual significance as clues and leads are painstakingly searched out. It is a strategic area, and because there

are sound reasons to believe that important solutions to certain problems may be discovered reasonably soon, research in this field probably offers the greatest challenge of the cardiovascular diseases.

F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

What are the weaknesses, gaps, problems, needs in existing activities against heart disease and what can be done to strengthen them? A frank appraisal shows, that, while the national heart effort is healthy and progressing it, like all human endeavor, is not perfect and has room for improvement. Heartening is the fact that gaps and obstacles are recognized and that positive suggestions for overcoming them have been made.

Research, research facilities, and research training

The support of medical research should be strong, undertaken with the realization that desired solutions cannot be guaranteed by a stated date but that it is extremely important to build up a continuing flow of basic knowledge which, though not of significance in prevention or treatment of disease at the moment, provides the raw material from which will come clinical discoveries, developments of great human and economic benefits.

While basic research is continually mentioned as paramount, perhaps too many of those engaged in scientific investigation are having to deal with the immediate, practical aspects of studies rather than with longer term, fundamental inquiries. This overemphasizes the treatment aspects of disease. Especially, it has been said, is this true in the field of high blood pressure. Great attention has been given to developmental aspects of presently available therapies. There has been left undone basic research, that could be and should be done, as to the causes and mechanisms of high blood pressure. Thus, a most important need is for more researchers to devote more time to trying to get behind what causes this and the other major heart diseases.

As a corollary, there is a need for the training of people in the basic sciences. This comes up hard against the problem of where to find the people and where to train them which, in turn, leads to the needs of medical education. These needs are of transcending importance in many ways.

Stronger efforts must be made toward solving more of the problems of medical education or the recruits from which the medical research field hopes to draw new material, in terms of bright young minds equipped to do the job to be done, will not be available in the needed numbers.

The medical schools need adequate financing in order to expand or improve for the public good, to educate more doctors and research workers. But, given funds and assuming that enough trained men and women were developed, another problem arises. There is not the money to build the laboratories and equip them for these workers. There is not even enough in the way of facilities today for workers who could do high calibre research and would like to do it.

A more urgent need at the very moment is for some space to put men to work in, work that could be started if there existed the space and facilities for them to do research. The lack of support for the construction of research facilities is therefore a serious weakness.

Such support should be provided and will mean much to heart research progress, bringing nearer the day of heart-disease conquest. But since the conduct of additional research imposes further administrative and overhead costs upon medical schools and institutions, this need should also be more adequately met. The medical schools are in the situation today of not being able to live without research money, but they are going into the red more heavily the more research money they take.

Another interwoven need that demands constant attention is the continuing improvement of the disemination and interchange of scientific information. Thus scientists throughout our country and our allied nations by learning what each other is finding out, improve, check, correct, and push ahead to new frontiers of knowledge. Perhaps the most important way we have in the United States of disseminating information is through the personal meetings at scientific gatherings of people who are doing the work and can best exchange facts and views face to face. Funds and other support are necessary and important therefore, for strengthening the ways of dissemination and exchanging knowledge. One area which deserves consideration and action is that of providing more adequately for scientists to attend important technical and professional meetings; particularly it has been said, is this a need among the younger scientists.

Another concurrent weakness has developed. Stability and continuity are not given to research workers who have shown themselves worthy. This arises from the repetitive nature of short-term grants. A satisfactory program has not been developed whereby it can be ensured that the very best potential personnel is being recruited for research, that they are utilized well, and that the insecurity of their support is lessened. This is the key for future expansion and deserves consideration and action. Better continuity and stability of resources are essential.

The awarding of research support to investigators is an expression of confidence in the ability of the workers; it is not a purchase of a guaranteed answer; research is the seeking of truth wherever or whatever it may be.

The freedom of scientific inquiry is greatly heightened and the greatest progress won when support and research administration are diversified and in multiple agency hands rather than concentrated in a single authority. Furthermore, both public tax support and support by private contributions are necessary; they are complementary and supplementary to each other; and the use of both private and public resources ensures that heart research will be done with the sole objective of producing knowledge for the common good of our citizens.

Professional education

The medical schools have manifested not only interest and willingness but also have taken positive action, to the extent that available funds and support and the particular condition within each school permits to strengthen and improve heart teaching. The direction that this effort must take varies from school to school and can only be determined by the school itself in the best American tradition of academic freedom. In some places the major needs are for differently trained personnel in some for additional personnel in others for im-

proved teaching equipment, and in still others for an expanded curriculum or greater coordination.

The programs of training for already-practicing physicians in the clinical aspects of heart disease conducted throughout the country through the auspices of medical societies and cooperating groups such as heart associations, health departments, hospitals, and medical schools, have strengthened in recent years and represent a healthy and encouraging facet of the nationwide endeavor against heart disease. Reflecting work toward meeting an increasing need these programs range from single lectures through short courses, symposia, clinics, longer-term courses, and so on to sustained, intensified training for a year or more.

If these programs were not in existence, or if they were not to continue to grow, a serious gap would be left in the national attack on heart disease. For through them physicians and allied workers (because training for professional personnel like nurses is of importance, too) are better fitting themselves for clinical and other phases of activity in heart disease, in private practice, in teaching, and in public health.

Public education

Today a steadily developing program of public education is being carried out nationally, statewide, and locally through the structure of public and private agencies concerned with heart disease. Educational activities constitute a vitally important part of the total heart program, and their continued development should be supported and encouraged as one of the essentials for progress.

Community service and public health

Until just a few years ago, there were heart programs in only a very few communities and States. Medical schools and societies, and health departments, had some interest and activity, and the small number of heart associations then existing were working valiantly. There was no nationwide spread of activity seeking to develop community heart programs as a vital part of a well-rounded community public-health program.

While the status of development of community heart programs is highly encouraging compared to 5 years ago, it should be emphasized that these programs are, in most areas, only in their infancy.

To state the need here in the simplest terms, it is for time, manpower, funds, and increased interest not only in communities which at present have no heart program, but also in those which have made beginnings with varying degrees of success.

Specifically the gaps lie first in the need for coordination of the activities of community resources so that the heart program will be soundly based and achieve maximum effectiveness.

Second, improvement can be made in providing more training opportunities for physicians and public health and welfare workers in making heart clinics better and better, in public health nursing services, in medical social services, in restorative or rehabilitative services, in preventive work, and other things that a community can do against heart disease.

While increased funds and more trained personnel are essential in further progress, strong public and professional interest are equally,

or more, essential in the community. The greatest progress in the development of community heart programs can only be achieved in the truly democratic way, with each community, alert and informed, recognizing its own needs and building its own program to meet those needs, utilizing not only appropriate local, State, and Federal public funds and facilities, but also private resources as well.

Future progress

It is in the therapy of damage—the treating of existing disease—that the chief medical advances against high blood pressure and the consequences of hardening of the arteries have heretofore been made. Still more benefits for the already damaged heart and blood vessels will undoubtedly be developed.

But it is from the seeking out of the unknown, underlying factors behind the rheumatic, the hypertensive, and the coronary diseases, which account for a vast majority of the deaths from heart ailments, that the greatest dividends will eventually come.

Once any of the presently unknown causes underlying these three is discovered, a great deal will have been accomplished. Of course, progress in the control of heart disease in 1 or all of the 3 great brackets may be made through the extensive and intensive application of partial measures which have emerged or are emerging almost daily from the laboratory. But medicine's most complete conquests over disease are largely embodied in the history of the discovery of specific or contributory causes of diseases; the greater benefits almost always await such discovery. Here, then, is the hardest core of the problem.

Scientific research is the method to get at this core, and there is agreement among medical, scientific, and public-health authorities that wide, intensive, prolonged, and collaborative investigation is the paramount factor in developing the nationwide heart program. This research, it is also felt, can best be done in an atmosphere of freedom without regimentation and with support from diversified sources rather than of a completely centralized resource.

Results of such research may arise from a modest laboratory where a single scientist makes a discovery for which hundreds of others in great laboratories have been seeking. Or results may come from a large group of workers of which each subgroup concentrates its efforts, in accord with its specialized interest and training, upon one or more aspects of a problem. Both kinds of endeavor, of the individual and of cooperating groups, must be supported and encouraged in any comprehensive and adequate research program. The fields of research from which discoveries of benefit for the heart may come are, moreover, not merely those in which lie the primarily cardiovascular investigations. They may arise from other areas of general medicine or basic scientific research, and intelligent support does not circumscribe itself too narrowly.

Although the further knowledge that research must provide is highly important, there is much that can be done today in the way of establishing and improving the application of what is known already.

There is today large sympathy for and a growing understanding of the needs of "disease control" as well as research and other activities in the national heart program. Realization of the public health im-

portance of heart diseases has crystallized in the last few years among the public and physicians and scientists. Today there are active associations, both of medical and of public members, with years of solid groundwork upon which to base the strengthened programs which are needed.

The structure for a great national endeavor against heart disease has begun to be erected. Such a combination of forces, voluntary and official agencies in teamwork, has been characterized by many leaders as an ideal arrangement which provides the best way to achieve the conquest of heart disease. Thus the administrative machinery, both Federal and non-Federal, is well founded, organized, and functioning cooperatively. Given time, money, and public interest, it will attain the eventual, desired goal.

The eventual goal is, simply expressed, the prevention of heart diseases. Consequent upon this would be their reduction as the major cause of death before advanced old age, and the extension, as far as possible, of human life and health for both old and young through healthier hearts and circulatory systems. Toward this achievement is directed the attack upon the Nation's leading killer and great public-health problem.

On the part of many medical authorities and scientists there is today confidence that if we continue to strengthen the Nation's efforts within the next quarter of a century we can master much, if not all, of the *untimely* death and disability caused by the major types of heart disease.

CHAPTER V

CANCER

A. SUMMARY

Cancer is unquestionably on the increase in the United States, as in other parts of the world. In this country it was in 8th place as a cause of death in 1900, but today holds 2d place, outranked only by heart disease. Its current toll is 200,000 lives a year, and unless cancer illness rates are reduced, approximately 50 million people now alive will get cancer, and half of them will die of it.

The cost of cancer, in terms of both economic loss to the Nation and expense to individuals and public agencies, is enormous. The estimated total of 330,000 new cases diagnosed in 1953 represents a loss of $12 billion in goods and services. Of the estimated 700,000 cancer patients who received medical care in 1953, over 60 percent were hospitalized at a cost to them of more than $175 million. The average hospitalized cancer patient can expect to pay at least $885 for diagnosis and treatment.

The attack on the cancer problem is organized under two broad programs in which both private and public interests are participating. One of these programs is basic research, under which scientists of many professional disciplines are carrying on work to enlarge the body of knowledge of the nature of cancer and how it can be controlled. The other is a program through which such knowledge is applied at the clinical level.

Cancer work is supported and conducted by organizations which solicit donations for this purpose or which are privately endowed. Chief among these are the American Cancer Society, which annually receives around $19 million in voluntary contributions, and the Damon Runyon Memorial Fund. Professional organizations like the American Medical Association, as well as individual institutions such as Memorial Center for Cancer and Allied Diseases in New York City, are also engaged in the work.

Government support of this work is given largely through the National Cancer Institute of the Public Health Service, United States Department of Health, Education, and Welfare, which currently administers approximately $20 million appropriated by the Congress. About three-fourths of this sum is appropriated as grants-in-aid for research projects carried on in non-Government institutions throughout this country and to some extent in other countries. The remainder finances the Institute's own research projects in its laboratories at Bethesda, Md.

Although much remains to be done both in the laboratory and in medical and public-health practice before cancer is brought under effective control, considerable progress has been made, particularly in the last decade. While surgery and irradiation by X-ray or radium

are still the only means of curing cancer, the effectiveness of these techniques has been greatly increased, and improved palliative treatments have been developed, especially with chemotherapy. Improved management of preoperative problems and control of infection and body chemistry have extended the benefits of surgery to cancers heretofore considered inoperable. Likewise, development of super voltage X-ray generators and new types of radiation through advances in physics and engineering has greatly increased the effectiveness of radiation therapy in cancer.

Much of the progress that has been made against cancer has been due to improvements in case finding. Experience in the management of this disease has demonstrated that success depends upon a combination of early suspicion, accurate diagnosis, and effective treatment. Since half of all cancer involves parts of the body which are accessible to direct examination, the efforts of both public and private agencies in professional and lay education have been directed toward bringing patient and physician together.

Early diagnosis of cancer would be greatly aided by a universal test which would indicate the presence of the disease in any part of the body. Although such a test has not yet been developed, there are useful tests for cancer of specific sites, such as the cell examination technique for detection of cancer of the uterine cervix. Another aid to diagnosis which is proving increasingly useful, particularly against the mounting incidence of cancer of the lung, is X-ray examination.

In the light of accomplishments to date, there are certain directions for future effort which appear to offer the best hope of further progress. In the area of laboratory research, study of the heritability of cancer is undoubtedly promising. The palliative effects of drugs on leukemia and other forms of cancer offer the hope that further work in the field of chemotherapy may produce treatments that will result in cures without the aid of surgery or irradiation. Especially promising in this respect is the experience thus far with hormones in treating cancer of the breast and prostate gland.

The field of radiation is still one of the most promising for cancer therapy, especially in the development of higher voltage X-ray apparatus, and improved techniques for using other means of radiation, especially radioisotopes.

Not to be overlooked are the opportunities for improvement in techniques of combining various types of therapy in treating individual cases.

Reduction of cancer mortality through earlier case finding will be accomplished by intensification of the combined efforts of public and private agencies to raise the index of cancer suspicion of general practitioners and alert the public to the necessity of cooperating with the medical profession.

B. WHAT IS CANCER?

Cancer is a disease of individual cells, the tiny units which combine in enormous numbers to make up the human body. It is a disorder residing within the individual cells, one which is passed on to become self-multiplying and malignant—resulting in death unless it is destroyed or removed. The causes of this disorder, this uncontrolled

cell growth, are not fully understood. A few inciters to cancer are known which act on the organism from without, such as X-ray, other ionizing radiation, sunlight, and certain industrial chemicals. More elusive are the natural causes of cancer. They represent the majority of causes, cancer scientists believe, and they must arise within the body, possibly within the affected cell or as inciters—like sex hormones—produced in one part of the body but creating malignancy in other areas.

Many clues to these natural causes have been found, but much more remains to be learned about their role in the origin and development of cancers. Besides flagging a number of agents and influences which may cause cancer, scientists have ruled out many factors once suspected. For example, there is no evidence that human cancer is caused by a germ, or that it is contagious or infectious. Nor will a single injury to soft tissue, such as the breast, cause cancer. In general, no food or combination of foods have any influence on the cause or the cure of cancer. Simple freckles, corns, and hemorrhoids do not turn into cancer. Cancer cannot be transmitted by kissing or by casual contact between persons or between persons and animals. So far as is known, a person's mental condition has no effect on the course of cancer.

Man has no monopoly on cancer, for it is found throughout the plant and animal kingdoms. The occurrence of the disease among human beings is worldwide. (See chart 7.) Some curious age, sex, racial, and geographical differences in its attack are apparent. For example, the American Cancer Society has found that the death rate from cancer of the breast is considerably higher for women in California or Maine than for women in Texas or North Carolina. Many varieties of cancer are known. These have certain characteristics in common, such as uncontrolled growth, the tendency to metastasize or spread widely in the body, and fatal termination if not treated early and adequately. Cancers differ in several ways, such as location in the body, appearance when seen through the microscope, and response to treatment.

Cancer develops in people of all ages and all races, in adults and children, in men and women. In men some of the common forms are cancer of the stomach, the lungs, the skin, the rectum, and the prostate gland. In women some of the most common forms are cancer of the uterus or womb, the breast, and the stomach. On the other hand, certain kinds of cancer—acute leukemia is an example—are found mainly in children. The cure of cancer, however, has little relation to age. The cure depends upon the extent of the cancer's growth at the time it is detected, and the adequacy of the treatment as well as the type of cancer.

CHART 7.—*Death rates, all causes, and cancer, by country—selected countries, 1940* [1]

Country	Total rate	Cancer rate	Country	Total rate	Cancer rate
Switzerland	1,201.0	176.0	Egypt	3,034.1	23.2
Argentina [2]	1,195.2	85.4	Mexico	2,335.0	23.2
Germany [3]	1,168.0	146.9	Guatemala [4]	2,146.0	11.4
Sweden	1,141.8	135.7	Chile	2,145.3	69.7
Norway	1,088.0	136.2	Finland	1,895.9	101.6
United States	1,074.1	120.0	France	1,886.9	133.3
Denmark	1,033.5	147.4	Rumania [5]	1,857.6	43.8
Iceland	960.4	126.3	Brazil	1,831.2	63.9
Netherlands	988.0	138.2	El Salvador	1,747.4	12.9
Canada	976.1	117.2	Costa Rica	1,708.7	62.8
Australia	972.4	116.8	Venezuela	1,659.8	25.8
Uruguay	960.3	98.8	Japan	1,652.4	70.9
Union of South Africa	940.3	104.7	Spain	1,641.9	65.3
New Zealand	923.6	120.2	Belgium	1,612.1	119.9

[1] Rate per 100,000 population.
[2] 1936 rate.
[3] 1938 rate.
[4] 1943 rate.
[5] 1939 rate.

Source: Summary of International Vital Statistics, 1937-44.

C. THE HUMAN AND ECONOMIC BURDEN OF CANCER

Fifty years ago cancer was eighth in the list of causes of death in this country. It was preceded by Bright's disease, tuberculosis, pneumonia, diarrhea, enteritis, and diseases of the muscular system. Then, 78,000 persons a year died of cancer. Research was meager, and adequate technology was non-existent in many areas of science.

Today, cancer is the second leading cause of death, outranked only by the cardiovascular diseases. It is now the stated cause of approximately 1 out of every 7 deaths in the United States, claiming more than 200,000 lives a year. The importance of cancer as a cause of death is not confined to certain age periods, but extends across the entire life span. Between ages 5 to 14, and 35 to 74, it is the second leading cause, and only at ages under 5 and over 85 does it drop below third place.

Unless the cancer death rate for older people can be cut drastically, the number of persons affected by cancer will increase by more than 50 percent during the next 25 years, because a larger proportion of the population is living into the upper age brackets. If prevailing death rates at each age continue, in 1975 some 1,008,000 persons will be under treatment for cancer and 326,000 will die of it.

Surveys of 10 cities made by the National Cancer Institute in 1947 and 1948 indicated that cancer was being diagnosed at an annual rate of 319 new cases per 100,000 population, and that 430 of every 100,000 persons were under treatment for the disease sometime during the year. From these findings rates for specific age categories were computed and applied to the United States population for the purpose of making national estimates. The incidence (new cases per 100,000 population) for the country in 1950 was estimated to be 328 and the prevalence rate (cases under treatment during the year per 100,000 population), 441.

The emphasis on the increased risk of developing cancer at the older ages should not conceal the fact that a very substantial number of cases are diagnosed among children and young adults. In the

morbidity surveys mentioned above, 15.6 percent of all cancer cases diagnosed during the study year were persons under 45.

Annual rates for incidence, prevalence, or mortality do not adequately describe the total cancer problem. Cancer investigators have to consider the risk of the disease developing over intervals as long as 10 or 20 years. Unless there is a reduction in the proportion of people who get cancer, of 100 people born during 1950, 32 will develop cancer at some time during their lives; cancer will develop in 3 before age 45, in 14 before age 65, and 23 before age 75.

If cancer illness rates are not cut, approximately 50 million people now alive are going to have cancer, and 25 million will die of it.

About 530,000 new cases of cancer are estimated to have been diagnosed in 1953. Probably three-fourths of the potential economic production of these cancer victims will be lost to society. Taking the age distribution of new cases of cancer into account, and counting as lost only those years that an individual may be considered as productive, the discovery of 530,000 cancer cases represents a loss of 3.5 million man-years of work. Current estimates fix the average annual contribution per member of the labor force (age 18 to 65) to the gross national product at $3,500. Thus, the cases of cancer diagnosed in 1953 alone will cost society $12 billion in lost goods and services. This does not include the cost of medical care and the value of the potential economic productivity of persons caring for cancer patients.

Data collected by the National Cancer Institute indicate that of the more than 700,000 cancer patients who received medical care in 1953, over 60 percent, or nearly 450,000, occupied hospital beds for an average of 27 days, at an estimated total cost to them of more than $175 million.

According to a study conducted by the American Cancer Society for the Vermont State Cancer Commission in 1947, the per diem charges accounted for three-fifths of the total amount billed by hospitals. Assuming that this relationship still holds, a per diem rate of $10 means an average cost per hospital day of $16 to $17 to the cancer patient, and the estimated average total cost of hospitalization to the patient amounts to $535. On the basis of the schedule of fees for surgery and supporting services contained in typical Blue Shield plans, an individual from a family of low or moderate income can be expected to pay at least an additional $350 for physicians' services (diagnosis, surgery, radiation, and followup care). Individuals normally earning higher incomes would pay considerably more. Thus, the average cancer patient hospitalized (3 out of every 4 cases diagnosed) can expect to pay at least $885 for diagnosis and treatment. These estimates are minimal because they do not take into account the cost of care subsequent to hospital discharge (stay in nursing and convalescent homes and medical care in the patient's home).

The cost of medical care to cancer patients not requiring hospitalization or discovered too late to warrant treatment (1 out of every 4 cases diagnosed), can be fixed at $100, at least. Again, this figure does not include the cost of nursing or convalescent home care. For all cancer patients, whether hospitalized or not, the cost of diagnosis and treatment would average at least $700. The Vermont study suggested that 1 out of every 10 cancer patients hospitalized at present can be expected to run up hospital bills of more than $1,070.

Patients and their families are confronted with these bills at a time when income is drastically reduced through either loss of income by the wage earner or the necessity of hiring housekeeping help. It is not surprising that, according to the Vermont experience, slightly more than one-fifth of the patients were unable to make any payment from their own resources toward their hospital bills. More than one-fourth required some charitable aid in the payment of their bills. Two-thirds were able to pay their bills in full from their own resources.

Mortality statistics and loss of man-years due to illness from cancer do not show specifically the impact of this disease on the basic unit of society—the family. Illness of any kind can be financially upsetting to an ordinarily self-sustaining family. A terminal illness involving long-term, expensive treatment is usually overwhelming. When the cancer patient has been the breadwinner, cancer is a total family catastrophe.

It is difficult, if not impossible, to assess the effects of the loss of status or self-respect when a family is forced to accept relief which they had never previously needed. The long-term effects on children whose mother must assume the principal wage-earning role because of the father's illness, are as difficult to measure as the problems faced by the father of small children when their mother is ill with cancer. One-third of all cases of cancer in women occur between the ages of 35 and 55, when their children are of teen-age. Nearly one-fourth of all cases of cancer in men also occur at these ages.

Rehabilitation is a serious problem for the cancer patient who has been made well enough to work. Quantitative figures on this aspect of cancer illness are scanty, and what is known is dismal. Most industries refuse to employ individuals who have had cancer because of the increased risk of compensable illness. New opportunities for creative or productive employment are difficult to find for many cancer patients, particularly males. Thus, there is nearly a total socio-economic loss to the community in the case of male cancer patients, and a substantial one with female patients, even when they have survived their initial course of treatment for the disease. This difference between posttreatment experience of males and females is consistent with the more general satistical fact that while the rate of onset of new cases of cancer is practically equal for males and for females, the mortality rate from cancer in males is now higher than in females. The reasons for this latter fact are not clear and systematic exploration in this field is indicated.

Most people know what happens to a person with advanced cancer. The medical, social, and economic effects of the late stages of cancer tend to perpetuate delays in diagnosis. Dread of pain and of physical or economic dependency has been found to be an important factor influencing people to delay in seeking medical advice when cancer should be suspected. This results in an ever-widening circle of loss to the community and to the Nation.

D. THE NATIONAL ATTACK ON CANCER

Efforts to control cancer, supported by private or voluntary interests, are conducted nationally and locally by such organizations as the American Cancer Society, and various foundations and funds such

as the Damon Runyon Fund, Anna Fuller Fund, Jane Coffin Childs Fund, and the Pardee Fund. Professional organizations such as the American Medical Association also support cancer work, in addition to special cancer centers like the Memorial Center for Cancer and Allied Diseases in New York, the Nathan Goldblatt Memorial Hospital at the University of Chicago, and the Children's Medical Center in Boston.

Public or Government-supported efforts are spearheaded by the National Cancer Institute of the Public Health Service, United States Department of Health, Education, and Welfare. Other public agencies engaged in this work include, on the Federal level, the Atomic Energy Commission and the Veterans' Administration, and on the State level the various State health departments.

The American Cancer Society, a national organization with headquarters in New York City, is supported entirely by voluntary contributions. It has 60 divisions chartered to carry out its program of cancer control in every State, the District of Columbia, and Alaska, and has affiliations with organizations in Puerto Rico, Hawaii, and the Canal Zone. The 60 divisions have organized local units in substantially all of the 3,000 counties of the United States.

The program of the society falls into the broad categories of research, education, and provision of cancer facilities and services. Its research program is carried out through project grants-in-aid, institutional grants, and fellowship grants. The project grants are awarded to research workers throughout the country on recommendation of the Committee on Growth of the National Research Council, which is assisted by a number of advisory panels. Institutional grants are made to research institutions and are designed to foster investigative activities and productivity in cancer research beyond that possible by isolated workers or individual disciplines. Fellowship grants enable young scientists to obtain training in cancer research. Considerable statistical research, including epidemiological studies, is conducted directly by the society's national office.

The educational program includes clinical fellowships to young physicians to enable them to obtain training in cancer diagnosis and treatment, activities which help to advance the practicing physicians' knowledge and skill in cancer diagnosis and treatment, nurses' training programs, and activities looking toward the spread of cancer information generally, with a specific aim of teaching the public the signs and symptoms of cancer and encouraging them to seek prompt medical care.

Service and facility activities include aid in the establishment and support of cancer clinics, organization and support of cancer detection centers and information centers, and the rendering of services directly to cancer patients such as loan closet services, transportation services, aid to local visiting nurse services, furnishing of cancer dressings, housekeeper services, and a limited amount of aid in paying for medical services or drugs.

The cancer activities of the American Medical Association, which reach practically all physicians in the country, are chiefly in the field of communication of information. The AMA makes available to its members, through its weekly journal and other types of publications and services, the latest information on cancer diagnosis and treatment,

new research findings, etc. Through its research committee it collects information on cancer treatments, evaluates the results and makes the information available through its publications. Another one of its activities is the investigation and expositon of cancer nostrums and quackery.

The Damon Runyon Fund is a national fund established in memory of a noted journalist. It supports cancer research projects and cancer research fellowships. Since its establishment in 1946 it has collected nearly $8 million. None of the money collected is used for administrative expenses, these being defrayed by Mr. Walter Winchell, the founder of the fund, and some of his friends. The Damon Runyon Fund holds an annual 2-day conference in cooperation with the New York Academy of Sciences for current and former cancer research fellows.

The program of the National Cancer Institute, supported by Federal Government appropriations, includes laboratory and clinical research in its own facilities at Bethesda, Md., and support of similar research at other institutions throughout the country by means of grants-in-aid made on recommendation of the National Advisory Cancer Council. In addition, a research fellowship program provides experience and training opportunities in research for promising young scientists. Cancer teaching grants are given to medical and dental schools, cancer control grants are made to the States, and training grants provide special cancer training and experience to practicing physicians.

The Atomic Energy Commission is concerned with studies of radioactive materials as cancer causative agents, and the application of new sources of radioactivity to the treatment of cancer. Its work is conducted both in its own laboratories and privately owned facilities, all under contract arrangements. None of the research laboratories is operated by the AEC itself. The four major AEC centers conducting cancer therapy research are at Brookhaven, N. Y.; Oak Ridge, Tenn.; Chicago, and San Francisco. Each is affiliated with a large number of universities.

The Veterans' Administration conducts cancer research in some of its hospitals.

The Committee on Cancer Diagnosis and Therapy of the National Research Council was formed in November 1950 at the request of the American Association for Cancer Research, the American Cancer Society, the American Medical Association, the Damon Runyon Memorial Fund, the National Cancer Institute, and the Food and Drug Administration. The objective of this committee is to determine the efficacy of various proposals for the diagnosis and treatment of cancer, and to provide information, advice, and opinions to the organizations that sponsor and support its activities.

Broadly speaking, the total cancer research effort of the Nation is directed at two main objectives: the acquiring of more knowledge about cancer and methods of controlling it, and putting this knowledge to immediate use as it becomes available. Although there is a difference of opinion among scientists as to the direction research should take, in general cancer studies deal with such phases of the problem as (*a*) the initiation of cancer (what agents produce it, in what body organs, how their effects are produced, etc.); (*b*) the nature of cancer and its relation to the host (what the relationship is between

the structure of a tumor and its function, what chemical mechanisms take place in cancer tissue, the effects the growth of a tumor has on the body organ in which it develops and on other body organs, etc.): (*c*) treatment and palliation of cancer (studies of the effects and final results of various types of treatment, development and testing of new modes of treatment, etc.).

Specific cancer research projects deal with such subjects as hormones (both as cancer-inciting and cancer-controlling agents), the relationship between nutrition and cancer, studies of cancer of specific sites of the body, studies of specific types of cancer such as Hodgkins disease, leukemia, melanoma, etc.; the role of heredity in cancer, the development and evaluation of diagnostic tests, studies of ionizing radiations, and with the discovery and development of means of control of factors in man's environment which relate to the occurrence of cancer. Hundreds of studies are being conducted to elucidate these questions and to discover fundamental facts in many fields of science which will help in the solution of the cancer problem. Engaged in this effort are the major scientific institutions of the country, the accredited schools of medicine and research hospitals, and many hundreds of individual scientists, physicians, and research technicians.

Educational activities are of several different types and are directed at different groups—the scientist, the practicing physician, the specialist such as the surgeon, radiologist, and pathologist; the nurse, and the public generally. The work is carried on through the professional schools, hospitals and laboratories, and by means of institutes, conferences, and refresher courses. All types of educational media are used, including the general medical journals, specialized professional journals, and a cancer monograph series published by the American Cancer Society. Motion pictures produced jointly by the American Cancer Society and the National Cancer Institute, exhibits and various types of publications are used both for professional education and for information of the lay public. The grants-in-aid made to medical, osteopathic and dental schools by the National Cancer Institute to improve the teaching of cancer to undergraduates, and the specialized programs of clinical traineeships for physicians conducted by both the National Cancer Institute and the American Cancer Society continually increase the numbers of young physicians with 1 to 3 years of special training in the diagnosis and treatment of cancer. For example, the American Cancer Society awards 88 such fellowships annually. In addition it gives 15 fellowships in exfoliative cytology which permit qualified pathologists to spend varying periods, up to a year, in acquiring proficiency in this diagnostic technique, and a number of other fellowships to permit young physicians who have already obtained extensive training in radiation therapy to study for a period of 1 year in Europe. State or local units of the society also provide scholarships for nurses. The National Cancer Institute has also given fellowships to more than 800 young scientists for graduate training.

An important segment of the educational program has to do with the training of young scientists to prepare them to carry on scientific research. The Damon Runyon Fund has awarded 256 such fellowships to people in 170 institutions in the United States and abroad. The American Cancer Society reports that since the beginning of

its research fellowship program in 1946 it has awarded 376 such fellowships.

Education of the lay public is conducted chiefly by the American Cancer Society, with which the National Cancer Institute has cooperated in the production of educational materials such as films and pamphlets. These activities are carried on through all the usual channels employed in public educational work, including such specialized facilities as cancer information centers and cancermobiles. Science writers are encouraged to visit cancer research laboratories throughout the country in order to report research progress to the public.

There are in the United States 11 cancer hospitals, approximately 475 cancer diagnostic and treatment clinics, and 175 cancer diagnostic clinics approved by the American College of Surgeons. There are also about 240 cancer detection centers, the primary objective of which is to uncover unsuspected cancer in presumably well persons. The largest clinical cancer center in the country is the Memorial Center for Cancer and Allied Diseases in New York City, composed of 2 hospitals, 1 public and 1 private, and a research institute. The Memorial Center handles about 10,000 cancer patients annually and does about 20 percent of the Nation's cancer research. As to the available beds for cancer patients, it should be emphasized that any hospital bed is a potential bed for a cancer patient. The American Cancer Society promotes the establishment of and gives financial aid in the operation of cancer clinics and cancer detection centers. The education of professional personnel is also an activity directed at providing better services for cancer patients, as this is the ultimate objective of such educational work. One specialized field in which there is a shortage of personnel is pathology.

The only national agency providing services directly to the cancer patient is the American Cancer Society, the local units of which carry on a variety of activities for this purpose. These are briefly enumerated in the section above in which the work of the society is outlined.

The activities of the various organizations, public and private, are coordinated through cooperative arrangements, direct exchanges of information, participation of members on each other's committees, boards of directors and advisory bodies, and through communication of information by means of publications and meetings.

The chief sources of funds for cancer work are voluntary contributions and congressional appropriations. The amount available to the American Cancer Society from public contributions for the calendar year of 1953 is approximately $19,800,000. From the establishment of the National Cancer Institute in 1937 to June 30, 1954, $131,500,000 will have been made available for that agency by the Congress. During approximately the same period the American Cancer Society has collected $120,800,000 from voluntary contributions. The amount appropriated for the National Cancer Institute for the fiscal year ending June 30, 1954, is $20,237,000.

The Atomic Energy Commission, which is also supported by congressional appropriations, estimates that it is currently spending between $3 million and $4 million on cancer projects. A few States also appropriate funds for cancer research. Other sources of funds especially for cancer research are the Jane Coffin Childs Fund, the Anna Fuller Fund, the Pardee Foundation, universities, hospitals, and individual private sources.

E. PROGRESS AGAINST CANCER

To achieve a substantial reduction of cancer, or what public health people call "control" of the disease, requires that the medical, social, and economic impact of the disease be minimized through preventive measures, effective treatment, or both. That these requirements have not been fulfilled is common knowledge, although the effort to control cancer has made tangible and significant advances along the broad avenues of treatment and prevention.

Surgery and radiation—X-ray and radium—have been and still are the only effective techniques available for curative therapy of cancer. They are curative only when the cancer cells remain localized to areas from which they can be removed entirely by surgery or destroyed by radiation. For cancer which is disseminated, surgery and radiation with other adjuncts of good medical care can be of considerable palliative value in prolonging life with reasonable comfort afforded.

Both surgery and radiation have become more effective in recent years for the treatment of cancer chiefly because other scientific and medical advances have permitted them to be used more extensively and adequately. Cancer surgery has become bolder, more extensive. Besides removing malignant tissues and neighboring lymph nodes, surgeons today often find it possible—to the great advantage of the patient—to remove adjoining organs and tissues that are frequent sites of extension of cancer. Restraint of tumor growth, through alteration of hormone balance by removal of endocrine glands, is another example of useful cancer surgery. Too, cancer often can be prevented surgically by the removal of benign growths, such as intestinal polyps, which may become malignant in time.

Until recently, infections, hemorrahage, shock, anemia, other blood deficiencies, faulty nutrition, and other secondary problems limited the amount of surgery or radiation that could be used in cancer treatment and the length of survival of the patient after treatment. Now, greatly improved management of these problems before, during, and after treatment is possible because of control of infection by antibiotics, control of hemmorrhage, better anesthesia, control of body chemistry, and other advances in techniques. As a result, the surgeon is able to extend both his curative and his palliative surgery to cancers which used to be considered inoperable. The operative mortality has gone down, the 5-year surgical-cure rate for some types of cancer has gone up, and many patients with disseminated cancer are living more comfortable and productive lives.

The development of new and more powerful radiation sources, through advances in physics and engineering, has greatly enhanced the effectiveness of radiation in the treatment of cancer. Super-voltage X-ray generators operate in therapy at several million volts with promising results. The betatron and other particle accelerators provide new types of radiation at voltages as high as 350 millions—soon to reach a billion volts. In addition, ingenious improvements have been made in methods for applying radiation. For example, rotational therapy, in which the patient is placed in a chair and slowly rotated underneath an X-ray beam, makes it possible to pin-point the radiation on the cancer with minimal harm to neighboring tissues.

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Radioactive isotopes, widely available since research on atomic energy reached its full stride, now make it possible to apply radiation therapy with particular advantage to certain cancers formerly difficult to approach. Radioactive iodine is valuable against cancer of the thyroid gland, radioactive phosphorus against chronic leukemia. Both radioactive iodine and phosphorus have practical value also in the localization of brain tumors, allowing their removal with improved precision. Also widely available throughout the country is radium or its new substitute, radioactive cobalt.

Although the use of chemicals against cancer, so-called cancer chemotherapy, is not established as a cure, certain chemicals have been found to have ancillary value when used with surgery or radiation. Even more important, some drugs have proved valuable in the palliation of incurable cancers, permitting the patients to live longer in comfort and to lead productive lives.

Materials now used effectively in the chemical treatment of cancer—either alone or in combination with other treatments—include hormones, nitrogen mustard, triethylenemelamine (TEM), triethylenephosphoramide (TEPA), and folic acid antagonists such as amethopterin and aminopterin. Cancerous conditions that have been benefited with these drugs, although not cured, include Hodgkin's disease, chronic leukemia, acute leukemia in children, lymphosarcoma, neuroblastoma, certain brain tumors, some cancers of the breast, of the lung, of the bladder, and of the prostate gland.

Notable progress has been made in the treatment of acute leukemia in children. Before 1947, when the drugs known as the folic acid antagonists were introduced, a child who fell prey to this disease of the blood-forming organs usually survived less than 1 year. There is still no cure, but, today, with skilled application of the folic acid antagonists, 30 to 50 percent of children with acute leukemia enjoy almost complete remission of symptoms for worthwhile periods of time. For example, at the Children's Medical Center in Boston, such treatment of almost 400 children with acute leukemia prolonged life in about two-thirds of the young patients. Some have survived more than 2 years after onset of the disease, with 1 boy having survived for more than 4 years.

Recent years have also seen in the United States the development of an organized national research attack on cancer, one which includes in its scope the major scientific institutions of the country, the schools of medicine, research hospitals, and many hundreds of individual research scientists, physicians, and technicians. The greater part of the massive growth in cancer research has occurred since 1945. This remarkable development has been in two areas. First, there has been a vast expansion of laboratory facilities across the country, aided by the training of hundreds of scientists to man them. Second, the viewpoint of cancer researchers has changed from pessimism to a reasoned optimisim.

Today, cancer research is financially supported from four principal sources: private endowment, voluntary public contributions, Federal Government appropriations, and by universities, hospitals, and other institutions. In 1953, the countrywide budget for cancer research amounted to about $15 million.

Investigations of the causation of cancer make up a large part of this research endeavor. Through these studies, certain basic princi-

ples relating to the initiation of cancer have been affirmed and reaffirmed in each of several species studied, including human beings. These include:

1. A wide variety of apparently unrelated agents—chemical compounds produced synthetically, naturally occurring compounds, radiations, and biologic entities—can cause cancer.

2. Most of the potent agents will evoke cancer in only a fraction of the population studied.

3. The cancers that follow application of a powerful cancer-producing agent develop after a long period of apparent well-being which may be measured in weeks or months in laboratory animals but is probably a matter of years in human beings.

Several studies indict a number of compounds present in the environment as agents that cause or contribute to the initiation of cancer in man. Such compounds are tar, some petroleum products, radioactive materials, certain metallic materials such as the chromates obtained in metal-smelting processes, certain aniline dye intermediates, and some other products or byproducts of industrial activity and modern civilization. From such findings it has been possible to prevent exposure to these materials by the industrial workers handling them. It is clear that numerous cancers, therefore, have been avoided. Such preventive methods will continue to pay inestimable dividends in terms of avoidance of human suffering, loss of life, and dollars.

Numerous cancer-producing chemical agents have been prepared synthetically. Also important in the production of cancer are the different forms of radiation: X-rays, the high-speed particles produced by radioactive materials and the modern apparatus employed in atomic energy research, and ultraviolet light. From studies in this field it has become evident that precautions must be taken by the patient receiving radiation either for diagnosis or treatment, by the doctor, and by those who work with radiation in laboratories, industrial plants, mining, and military operations.

Some cancer-producing agents (such as X-rays and the chemical, 3,4 benz-pyrene) induce a variety of tumor types in a number of different animal species; others (such as the agent causing leukosis in chickens, and the agent in the milk of mice that affects the occurrence of breast cancer in the offspring) induce cancer ordinarily in a single species. These findings indicate that, in addition to the many agents from outside the body—extrinsic factors—there are numerous intrinsic factors, in the laboratory animal and in human beings, which can affect both the initiation of cancer and the course of development of the established cancer.

The importance of hereditary influences in producing experimental cancer has been demonstrated by developing many generations of inbred strains of mice and other animals. This inbreeding provides an extremely valuable tool for cancer research, but the translation of these experimental results into clinical terms is most difficult since human heredity is the result of the opposite of inbreeding. Recent studies along other lines suggest that heredity may play an important part in the predisposition to some types of human cancer. Certain family groups appear to have a higher-than-ordinary concentration of breast and stomach cancer. In cancer of other sites hereditary susceptibility has not been demonstrated except in rare instances, and it may be that heredity has little or no influence in some types of cancer.

The hormonal secretions of the body constitute another important group of intrinsic factors about which much has been learned. Much remains to be done in this area of research, but the work has already provided information leading to hormonal treatment, so valuable in certain types of cancer, such as prostatic cancer.

Some researchers believe that all cancers are caused by viruses that lurk in the body tissues in an inactive form and are activated by extrinsic factors. Most cancer investigators, however, believe only a few cancers are caused by viruses. Recently, some experiments have been reported which indicate that leukemia can be produced in mice by injection of cell-free extracts of certain tumors into the young mice. If these observations can be confirmed, their implications are exceedingly important for new research, especially in that important type of cancer, leukemia.

Much has been learned about the nature of cancer and its relation to the host. A varied picture has been observed in the clinical nature of the disease in the patient and in the body site attacked. In addition, the behavior of cancer tissue has been found to vary considerably in such important respects as (1) progressive growth of the tumor, (2) transplantability, (3) invasiveness into the surrounding tissue, (4) the setting up of distant, new sites of growth, and (5) the production of hemorrhage in the area of the tumor.

Most of the knowledge of the chemical mechanisms in cancer tissue has been obtained with the past decade. Extensive study of the chemical properties of tumor tissues has shown that in many respects tumors tend to resemble one another more than normal tissues tend to resemble each other. In certain chemical functions, cancer tissue has been shown to be deficient; for example, in the ability to oxidize certain chemical raw materials. In other functions, cancer tissue exhibits remarkable activity, such as the ability to manufacture protein as the tumor mass grows. Out of this and allied studies—such as those concerning the problem of nitrogen metabolism in cancer patients—may come leads to new ways of treating cancer.

Important progress has been reported in other research aimed at developing better methods for treating cancer. In the field of radiation, many varied studies are going forward, besides those which led to the development of new techniques and new sources of radiation already described. Notable examples are the studies in laboratory animals of the biological effects of radiation. These studies are needed not only in cancer research but also because of the development of atomic-energy weapons. Especially important to both areas are the studies on radiation sickness. One significant result of this research is the recent finding that shielding of the spleen or bone marrow or the prompt administration of nonirradiated spleen or bone marrow material to an individual exposed to a normally fatal dose of radiation can prevent or counteract many of the usual consequences of such exposure. These discoveries give new leads to ways of protecting against large amounts of radiation. Highly specialized studies on radiation therapy are being advanced by the Atomic Energy Commission in research hospitals at Brookhaven on Long Island and Oak Ridge, Tenn., at the new Argonne Cancer Research Hospital in Chicago, and in the radiology laboratory of the University of California Medical School at San Francisco.

One of the main goals of cancer research is the discovery of a drug or drugs—that is, methods of chemotherapy—which will destroy the tumor or cancer tissue without injuring the other tissues in the cancer patient. If such a discovery were available, it would be the ideal therapy, for not only could localized cancer be treated without the mutilating effects of surgery and radiation but disseminated cancer could also be treated effectively. A single such drug for all cancers presupposes that tumor cells contain a component common to all types of cancer cells which distinguishes them from normal cells. No such component has been demonstrated as yet, and, although many cancer research workers do not believe such a component exists, certain similarities suggest the possibility of such a common factor. Since no such demonstration has been brought forward, scientists in chemotherapy are seeking chemical agents which will (1) modify the systemic toxicity produced by cancer, (2) alter the relationship between the environment of the cancer cell and the cell itself, (3) interfere with the blood supply of the tumor, (4) stimulate defenses of tissues adjacent to tumors against invasion, and (5) differentially damage functional and metabolic processes in normal and cancer cells.

Observations from many lines of basic research have resulted in the testing of well over 10,000 chemical compounds for ability to destroy cancers in animals. A number of valuable leads for treatment in the patient have come from the studies in animals.

The sex hormones, both estrogens and androgens, have met with a limited degree of acceptance in the management of breast and prostatic cancer. Since 1946 the American Medical Association has supported, with the cooperation of representatives of the drug industry, a far-reaching survey of the effects of sex hormones and allied substances upon the various forms of cancer. In all, 45 clinics and 65 inestigators joined in the survey. Much data have been accumulated and analyzed. In a relatively short time, thanks to this survey, the medical profession has been informed, through publications in the Journal of the American Medical Association and in other medical journals, of definite criteria for the selection of patients for hormonal therapy, definite dosage schedules, and the dangers inherent in the therapy.

Cortisone and ACTH appear useful in modifying the course of certain types of leukemia and the lymphomas. Urethan has been used with a measure of success in some leukemias and myelomas. Nitrogen mustard has been of benefit in treating some of the leukemias and lymphomas, particularly Hodgkin's disease. The folic acid antagonists are in general use against acute leukemia in children. More recently, new agents such as the purines and pyrimidines have shown promise in the treatment of leukemia patients at the Memorial Cancer Center in New York and elsewhere.

Progress in the control of cancer depends not only upon continued advances in research but upon rapid application of the products of research to the problem of discovering and treating individual cases. The promotion of such application through the development of case-finding techniques and programs of public and professional education has become in recent years a major and fruitful line of endeavor for both Government and voluntary groups.

The key to successful medical management of cancer is finding and treating the disease early. Thus, the watchwords, for the lay public as well as the medical profession, are "early suspicion, accurate diagnosis, and effective treatment." The two main objectives are: First, to find ways to shorten the dangerous time intervals between the onset of cancer and diagnosis, and between diagnosis and the start of treatment; and second, to improve the level of cancer diagnosis and management.

About one-fourth of patients with cancer today, receiving proper medical care, are being cured. With the methods of treatment now at hand, it has been estimated that twice this number could be cured, if early diagnosis and prompt adequate treatment could be achieved in all cases. Because of the importance of early diagnosis to successful treatment of cancer, educational programs in this field give much emphasis to the importance of frequent medical examinations with reliance upon all available aids to diagnosis.

There is now no single screening procedure or test which will discover early cancer of all types. However, tests for cancer of specific sites have been devised which are valuable case-finding tools. Perhaps the most useful of these is the cell examination technique, called exfoliative cytology, developed by Dr. George N. Papanicolaou and Dr. Herbert F. Traut. It has proved effective as a diagnostic aid in cancer of the bladder, lung, and stomach, and especially valuable in the detection of uterine cancer, the leading cause of cancer deaths among women. It has been demonstrated that this technique can indicate the probable existence of uterine cancer, even in the absence of the usual signs or symptoms, when the disease is most curable. Exfoliative cytology is being used routinely in numerous medical centers across the country. The combination of this technique with other diagnostic procedures and adequate treatment in all physicians' offices should eventually result in control of this type of cancer, many cancer experts believe.

Of great importance to the control of cancer have been the efforts devoted in recent years to the improvement of cancer teaching to undergraduate students in medical and dental schools, and to a lesser degree, in nursing schools. These efforts have given graduates of these professional schools a better understanding of cancer and has better equipped them to handle the disease problem.

As the physician's index of suspicion of cancer has been raised, it has also been necessary to show the lay public the importance of cooperating with the medical profession for control of cancer. About 2 million women have seen the movie, Breast Self-Examination, produced by the American Cancer Society and the National Cancer Institute to lead the attack on breast cancer. In one year, 1952, more than 18 million pamphlets describing cancer were distributed, over 400,000 posters were displayed, nearly 45,000 showings of movies were arranged, and a vast number of articles, editorials, and news stories were published on cancer in newspapers and magazines. At places of work in businesses and industries in Iowa, Michigan, Georgia, New Hampshire, Alabama, and other areas, more than 5,000 cancer educational programs were conducted for a total audience of nearly 900,000 people. High school and college programs reached well over 1,300,000 students.

Recent studies show that the effort in health education of the public has been effective. The American Cancer Society has found that virtually every study of the trend of the factor of delay for which the cancer patient is responsible has shown a consistent lowering in the element of delay. To put it another way, the public is not only better informed about cancer than at any time in history, but more patients are being seen with earlier cancer than ever before, with the significant result that more lives are being saved. With progress in research and therapy, the problem of professional and lay education will grow. There will be more to tell, and the dividends from early detection will be higher.

Persons who have been treated for cancer are sometimes left with handicaps to which adjustment is needed. Efforts by the American Cancer Society and other agencies to aid in rehabilitating such persons have been expanded considerably during the past few years. Courses of instruction have been developed for individuals who must learn a means of speech after operations for cancer of the larynx (voice box). During 1952, new speech clinics of this type were conducted in Michigan, New York, Indiana, Texas, and Delaware, and at Cleveland, Ohio, the first international convention of these groups was held, sponsored by the Cleveland Hearing and Speech Center of Western Reserve University, the Cleveland Academy of Medicine, the Ohio Bureau of Vocational Rehabilitation, and the Cleveland Otolaryngological Club. Rehabilitation services, however, have other aspects. For example, in Idaho, former cancer patients are helped in finding and keeping jobs. In South Carolina, they are aided in learning new trades.

Evidence from a number of sources supports the validity of the great national effort to control cancer.

In 1937 a study based on all cancer patients admitted to hospitals in Vermont yielded the fact that only 20 percent had localized disease and were considered candidates for curative treatment. A study in the same State 10 years later showed that the percentage of cancer patients admitted to Vermont hospitals with localized disease had risen to 58.

Among breast cancer patients seen in the Mayo Clinic between the years 1910 and 1919, 63.6 percent were found to have involvement of axillary lymph nodes. That is, the cancer had spread from the organ of origin to neighboring lymph glands—an unfavorable setting for cure. Of the breast cancer patients seen in the same clinic in 1945, the proportion with axillary nodal involvement had dropped to 45 percent. These figures are reflected in the steadily rising cure rates reported from that clinic. Of all patients with breast cancer operated on in the period of 1910–14, 39.7 percent were living 5 years later. Of the patients operated on during the period 1940–44, 62.4 percent were living 5 years later. This experience has been confirmed by that in the Memorial Center for Cancer and Allied Diseases, New York.

An analysis of the cancer death rate among female policyholders of the Metropolitan Life Insurance Co., reported in 1949, showed an 11 percent decline in the total cancer death rate during the decade 1938–48. In the age group 55 to 64, where cancer is most frequent, the percentage decline was 15.1.

In the statewide cancer registry of Connecticut, steadily increasing survivorship rates were recorded in the interval from 1935 to 1941.

Of the males with cancer in the State of Connecticut, who were registered in 1935, 18 percent were living 5 years later, while of those registered in 1941, 25.7 percent passed the 5-year mark. For males and females combined, 5-year survivorship rose from 22.1 percent of the group recorded in 1935 to 33.5 percent of those admitted to the registry in 1941.

In general, it may be said that modern procedures have apparently increased the rate of cure of cancer from roughly 15 percent to roughly 50 percent. In the case of cancer of the breast the figures are roughly from 40 to 50 percent under the best circumstances. The cure rates for cancer of the stomach are substantially better than they were a decade ago. For cancer of the womb, substantial improvement has also been made within the last 10 years. There are better means for bringing about relief to many patients with widely disseminated cancer than were available a decade ago. Chemical treatment of cancer of the prostate can bring relief to men with advanced conditions in 80 percent of the cases. In Hodgkin's disease it is possible to alleviate symptoms for months in about 80 percent of the previously uncontrolled patients. Relief can be given to a substantial number of patients with leukemia, keeping them in comparative health and comfort for weeks and months, sometimes for years.

The mechanism for realizing the potentials for cancer control has been established, and the evidence at hand has demonstrated its soundness.

F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

Although the record of progress against cancer in a single generation is impressive, blanks remain to be filled in and many problems still await solution. Not the least of these arise from the very nature of cancer itself. Most investigators conclude that it is probably not just one disease with which science is contending in the study of cancer, but many. Or, if it is one, its manifestations are so many and so varied that each must be treated separately. Thus the search for a universal remedy which will be effective against all kinds of cancer must of necessity be a difficult one. Nor can a treatment which is successful in one kind of cancer always be used for all individuals suffering from that kind of cancer. For example, there are 7 or 8 kinds of cancer of the breast, each of which presents its own peculiar characteristics. The same type of breast cancer differs also in the various stages of growth at which it may be found.

Likewise, there are many factors which seem to have some function in the initiation of cancer as well as in its control. Various types of radiation act upon the genesis of cancer, and all of them possess the opposite characteristic of aiding in its successful treatment. Certain chemicals have been found to have value for treating cancer, while others contribute to its initiation and growth. Apparently there are agents intrinsic in the body itself which likewise contribute to the origin and growth of neoplasms. Whether these be few or very many remains a question. Whether, too, these materials are actual agents, or simply trigger mechanisms to set off the cellular process on its path of disordered growth is still another problem waiting final solution. Nor can the genetic factor be overlooked. But it is at least

an appreciable measure of progress in knowledge of cancer and its management that permits the formulation of these problems at all.

Research in the field of cancer poses its own problem. This is variously stated as the choice between pure and applied research, or between prevention and cure. Yet there can be no such choice. Progress demands both. However, within the limitation of funds and personnel to carry on the work, some selection of specific activities often must be made. In cancer, however, the investigator engaged in research which might be called pure or basic develops the ideas and even the techniques that the worker in the actual application of cancer knowledge must use. The case for planned research has its advocates and has had its good results. Some of these have been seen in the field of testing various chemicals for their cancer-causing properties, and various others for possible use in treatment. Most of the great inventions and even many of the great discoveries in medicine, such as the bacterial origin of disease, came through research not directly planned to bring them about. So it may be with new cures for cancer. Research in the general fields of cell behavior and the processes of growth, in the involved structure of protein molecules, in the activities of the ductless glands and the functions of their various secretions may well disclose, one day, the very solution that has eluded any planned and directed search for it. The need to create general understanding of this fact is one of the difficulties facing those who are responsible for carrying out any program on the nature and control of cancer.

Perhaps the most important step to be taken for more effective control of cancer is to remedy what has been called the gap between what we know and what we do. This is really a failure to apply knowledge to the control of cancer in the population. In order to increase the number of cured cases, the cancers must be found. Without doubt a substantial number of cancer deaths are avoidable. They could have been prevented had the cancers been found in time.

How can this gap be closed? There must be further studies of cancer as it is found in the human population. It is necessary to find the kinds of people likely to develop cancer. Such factors as race, climate, and geography need to be investigated for their possible relation to the disease. Then there is the age factor. There is ample indication that cancer is a disease of people under 40, and in children from 5 to 14 it is the second leading cause of death. What parts heritability and general habits play in cancer genesis should be further studied. Already much work has been done on the relation of diet to cancer. The relation of excessive smoking to lung cancer is presently much before the public.

With the country's continued industrial growth, and especially since some areas have been heavily industrialized, it has been necessary to consider the possible carcinogenic role of products and by-products of industry. For instance, it has been suggested that atmospheric pollution may contribute to the startling rise, both here and abroad, in the incidence of lung cancer, which is more prevalent in urban areas. Awareness of such dangers has been present from the beginning of work with radioactive materials. To meet the challenge of these problems, industrial concerns are constantly engaged in research to develop preventive measures against them. Lists of thousands of industrial chemicals which may be potential cancer inciters

have been compiled. Active work of prevention to exposure has been carried out in factories and plants of various kinds.

Extensive mass screening of the population to find cancer must await further development of diagnostic tests. Although there is as yet no single test for all kinds of cancer, success with tests for cancer of specific sites—such as the cytologic test as applied to cancer of the uterine cervix, and to a limited extent to stomach and lung cancer—offers encouragement to scientists seeking to develop more complex tests of body fluids and metabolism. The small X-ray used to screen for tuberculosis has proved valuable also in finding some lung cancer, and several cities plan further use of it, although the expense of large-scale use may prove prohibitive. It has been suggested that mass screening of men over 45 for lung cancer by this means might be practical.

Problems of another kind have to do with the catastrophic nature of the illness as far as its financial impact upon the patient and his immediate family is concerned. Memorial Hospital in New York City reports that the cost of its 10,000 patients a year is between $4 million and $7 million, and that the bill for the whole country would be $300 million to $400 million. This not only represents a financial burden that many individuals simply cannot meet, but means a loss of $12 billion annually in man-hours of work that the country needs. To meet this problem, several types of insurance have been developed, but premiums are high. There are some organizations which make money grants to individuals, and public hospitals are open to the indigent patient. But this still leaves unsolved the problem of the salaried worker who must pay for cancer illness, and the social and psychological impact upon him and his family in such cases. Private groups like the American Cancer Society, public agencies, and many hospitals are aware of the social and psychological difficulties involved, and provide help and advice to the patient and his family to help in easing the pressure arising from the illness and recovery period, or the period of terminal care.

Another very real and practical problem is the shortage of scientific personnel both for research into cancer and for its treatment. To encourage students to enter the work, both public and private agencies have been expending huge sums for grants usually to institutions where individuals are carrying on work whose promise is such as to merit this support.

It is already evident that these problems arising from the very nature of cancer, the obscurity surrounding its causes, the gaps in knowledge of its behavior in the human population, can be solved only by continued research in the laboratory, in the hospital, and through epidemiological and statistical studies. Full implementation of such a program depends upon the support of an informed public. Part of that educational job is the responsibility of the public and private agencies engaged in the field of cancer, part of it is the responsibility of the medical profession, part the responsibility of the public itself. There is ample proof of the last statement. Although millions of people have heard of the necessity for frequent physical examination, only a small fraction of the population takes advantage of that knowledge. The considered verdict of medical authorities over the world that only two methods of treatment—radiation and surgery—can cure cancer, has as yet failed to deter people from spending un-

known amounts of money and endangering what chances of recovery they may have by resorting to medical charlatans.

While knowledge of cancer is sometimes increased with startling suddenness, often long periods of apparent barrenness occur. There are, however, not merely hopes for progress against the disease, but definite indications of the paths along which it may lie. This is not to say that any certain paths are closed, or that new ones may not open.

Education of the general public will have to be depended upon to raise the index of awareness of cancer, which will surely result in an increasing number of early diagnosed cases, thus increasing the percentage of cures. There is every evidence that more physicians already practicing are seeking new knowledge about the treatment of cancer, that medical schools are doing a better job of preparing their graduates for practice in cancer, and that active recruitment of scientific personnel is bringing results.

In the field of basic research, the subject of heritability demands much more study. Controlled experiments with animals have shown that susceptibility and resistance to cancer are to some degree heritable. It is imperative that the relationship of this fact to cancer genesis, together with the relationship of a powerful stimulus to the host body, be thoroughly investigated. Investigations which attempt to define hereditary influences in terms of physiologic and biochemical activity hold much promise in the work on the cause of cancer.

Recent developments which reawaken interest in the virus theory of cancer seem promising. Leukemia has been induced in mice by injecting young mice with cell-free filtrate. This means, of course, that since there are no cells in the material injected into the mice, some viruslike agent, too small to be filtered out by present methods, must be responsible for the growth of cancer in the animals. If this work can be corroborated by further experiments, it will be exceedingly important in future investigations in that field. This is work of utmost importance, for acute leukemia is one of the dreaded diseases of childhood, and it also is found to some extent in adults.

Some of the most complex and difficult studies are the investigations into the structure and functions of the proteins. How these unbelievably complicated molecules are formed, and what their relationship is to growth, are questions fundamental to cancer knowledge. Attempts to synthesize these molecules in the laboratory may give valuable information as to the way the living body works, and what happens when the process is interfered with.

Scientists have long suspected that a growing tumor produces or elaborates some material which affects the body in certain ways. When a tumor reaches a certain size, there is evidence of an effect on the liver by reason that the activity of a certain enzyme called catalase is reduced and then increased again when the tumor is removed. When a material obtained from the tumor is injected into the host, a like change occurs. Further investigation of the material obtained from the tumor and of the mechanism of the reduction of activity in its presence, or in the presence of a tumor, seems to offer the promise of greatly increasing knowledge about cancer causation.

It is well known that nitrogen is an essential element in all tissue. It has been found that a growing tumor robs other tissue of this necessary nitrogen and continues to do so, no matter how much the intake

of nitrogen is increased by diet. Investigations into nitrogen metabolism which are now underway should continue, for they can provide necessary information on the processes involved in the characteristic wasting-away of late-stage cancer patients.

Some of the most promising research is being done in chemotherapy. A drug which is capable of destroying tumor tissue without damage to normal tissue would be an ideal treatment for cancer. To find and test such drugs, or chemotherapeutic agents, is a formidable task. In order that it be done efficiently, clues as to the nature of such drugs are being sought. One valuable lead came through the use of sulfa drugs, agents which seemed to control bacteria growth by interfering with the utilization of some vitamin which was similar in structure to the sulfa drug. It was absorbed by the cell as if it had been the vitamin, and blocked the usual metabolism of cell growth. This gave investigators the hint that if they wanted to find a substance to inhibit a specific metabolic reaction, they should look for it among known substances whose metabolic reaction might be similar. This is called the antimetabolite theory.

One successful application of chemotherapy to cancer has been in leukemia. This is the treatment with nitrogen mustard. It was noted that mustard gas used in wartime cut down the number of white blood cells. Since in leukemia there are too many white blood cells manufactured at the expense of the red cells, it was thought that the use of nitrogen mustard might reduce the white cell count in leukemia cases. It was tried, and it worked. The search for other agents goes on. Chemotherapeutic studies such as this need highly trained investigators, and continually improved facilities.

Another avenue of inquiry is the possible carcinogenic as well as curative effects of certain hormones. The relation of the sex hormones to cancer both in stimulating and retarding growth is rather well known. The steroid hormones, as they are called, are manufactured by the cortex of the adrenal glands. They are a type of hydrocarbon, and comparatively simple in structure when compared with some of the proteins. They can be synthesized in the laboratory with much less work than can other proteins. They belong to the hydrocarbon family of chemicals, some of which are known carcinogens when found in the environment of the human individual. Up to this point, the steroids have not shown demonstrable effects on growth, although favorable results have come to patients with prostate and lung cancers when the adrenal gland was removed by surgery. This field of hormone and general endocrine gland secretions is one in which continued study is necessary. The dramatic success of ACTH in certain cases of arthritis indicates that other possibilities may reside in these hormones. Investigations are now in progress in the research hospital at the Argonne Laboratories on the relation of the steroids, and the endocrine glands, more especially the adrenals, to tumor cell growth. One group is doing this by feeding patients precursors of certain hormones which are labeled with tritium, a radioactive substance, and watching the synthesis of these hormones by means of these labeled radioactive constituents. This promises to open up some of the secrets of the relationships between these hormones and cancer. Such a study as this is possible because the facilities of the Atomic Energy Commission are available to the investigators.

The use of radioactive isotopes of various materials is one of the most promising methods of studying the behavior of substances in the body, of tracing areas of growth other than normal, of locating deep tumors. The whole concept is new. Already dramatic successes have been scored in the location and defining of brain tumors, the treatment of thyroid growths, and so on. With the coming of the peaceful uses of atomic energy on a large scale, the use of radioactive isotopes to unraval more of the mysteries of metabolism can be greatly increased. But the atomic scientists themselves warn that it will be an expensive process, and that it will require the most highly trained operators working with complicated and sensitive facilities.

The rapidity with which high-voltage radiation has developed as a means of therapy makes it almost presumptuous to prophecy what is ahead in that field. Even now, machines capable of generating millions of volts of controlled radiation are in use, such as a synchrocyclatron capable of producing a 450-million volt beam of protons, the positive, heavy electron. This beam can be directed into tumor tissue, concentrating its great power on a given area, thereby avoiding injury to surrounding normal tissue which has been the chief hazard heretofore in radiation therapy. Further development of rotational radiation, that is, moving either patient or machine so that the beam attacks the maligant tissue fom different angles, is certain. In this realm of supervoltage radiation the possibilities are limited apparently only by the cost of the devices necessary and the trained operators to use them. Additional training for personnel in this highly specialized field is certain to be needed.

There seems to be great promise, too, in the use of combined therapies for cancer. Already the radioactive isotopes are aiding in basic research on the structure and function of the cell and its components. They have been combined with surgery to delimit the boundaries of tumors such as those in the brain, and to locate deep tumors. Radiation and surgery, too, are a potent combination. In palliative care, many uses can be envisioned for combined therapies which will render terminal stage care more endurable.

Many studies are being carried on to discover new types of tests for cancer. Further extensions of the application of the knowledge of exfoliative cytology are unquestionably indicated. Several serological tests are undergoing investigation. Some of the studies, such as that dealing with the activity of liver catalase, may have test possibilities, as may others dealing with the use of proteins by the body. Just as combined therapies are found useful, so batteries of tests may be worked out, each test perhaps valuable for finding possible cancer of one site or one type; when all are used they may be widely inclusive.

None of these things is merely possible. All are in the realm of probability; some have been developed to the point of limited use. Time, money, and trained personnel—not necessarily greater numbers, but more highly qualified personnel—will be necessary for full development of these opportunities. One obstacle in the race of science against cancer is, of course, these costs. It is hardly necessary to point out that rising costs hamper all phases of this work, from education of personnel to cost of care of patients. It is a genuine problem which must be met somehow if the progress already made is to be held.

As expressed by Dr. Paul Steiner in his presidential address before the annual meeting of the American Association of Cancer Research in 1952:

> Progress in the past has been slow in human cancer, as in tuberculosis and some other diseases, but it has been steady. Decade by decade things get better. Progress has consisted of eroding away a few percent from the mortality of one kind of tumor this year, and a few percent of another type at a later time. The sums of these small victories adds up to the impressive figures totaled for some cancers. Progress of this type can be expected to continue. * * * To the initiate, progress in the terms of a few percent is apparent; to others it is not. We are fighting for the small percentages in each type of cancer and are grateful for the sum of numerous small conquests.

CHAPTER VI

MENTAL ILLNESS

A. SUMMARY

There is probably no more serious problem in the health field today than that of the mental illnesses. Much more has to be learned about the causes, diagnosis, and treatment of mental disease. Services for those who are already ill must be improved and expanded, preventive and control work must be increased. To accomplish these goals, we need more research, both laboratory and clinical, more people to carry on the research, and more facilities in which research will be encouraged and expedited. More trained professional people are required to treat and rehabilitate the mentally ill, and to conduct preventive and control work.

Specifically, the treatment and rehabilitation services in the mental hospitals need to be improved, research needs to be developed as part of the continuing responsibility of mental hospitals and other State and local institutions. As yet, very little is known about the cause, treatment, or prevention of the mental deficiencies; however, there are indications that much can be done toward fitting the mentally subnormal for socially useful life.

Community mental health programs (including clinic services, consultation facilities, and public education) with built-in evaluation procedures need to be developed. More effective techniques for carrying on these programs need to be investigated in field studies, and the application of new and improved methods speeded by means of demonstrations of mental health services. More and more professional people need training in consultative skills required to deal with community problems, and there needs to be more widespread application of psychiatric principles in school and industrial health programs, in the work of courts and other social institutions.

More studies are needed on the biological aspects of mental disease, the causes of the various mental disorders, and the prevalence and incidence of mental illness, with special reference to treatment of the mentally ill outside of hospitals and clinics. The earlier that treatment for mental illness can be instituted, the more hopeful the prognosis. More rapid and accurate diagnostic techniques, especially for early screening and detection of mental and emotional disturbances, must be developed. Currently known methods of treatment need to be evaluated and refined, and methods devised for determining when these treatments will be effective and when they will not. Controlled studies are needed to test the effectiveness of intensive treatment units in the receiving services of mental hospitals. There is need to search for and find more effective methods of treatment and to develop more effective and widespread programs for the rehabilitation of the mentally ill. More information about what happens to mental

patients after they are discharged from the hospital must be gathered through followup studies of former patients and patients in extramural care. And techniques must be developed and perfected for assuring that as new knowledge is acquired, it is transmitted as rapidly and effectively as possible to the professional personnel and the service facilities where it will be put to use.

There is much that must be done and learned in order to wage an all-out campaign against mental illness. But there is much that we already know and can do, given the funds, the people, and the facilities to do them with. The impetus provided by the Federal mental health program, the accomplishments of the professional societies in furthering knowledge and improving treatment, and the yeoman work of the voluntary and lay organizations have done much to speed us on our way. With greater public recognition of the importance of this vitally important health field, and with concerted efforts toward furthering research, training of professional personnel, and mental health services, the future should be promising. The stakes—both in terms of money and man—are too great for our Nation not to exert every possible effort and explore every possible avenue. The conquest of mental illness and the promotion of positive, mentally healthy, constructive human relations hold out for us the promise of a new frontier.

B. WHAT IS MENTAL ILLNESS?

Mental illness is not a single disease. It encompasses a broad spectrum of disorders which range all the way from the psychoses—or insanities, as they are commonly known—to those personality maladjustments which manifest themselves in socially destructive behavior. Included in this broad problem area are the psychoneuroses, those troubling states which incapacitate the person for normal living; the mental deficiencies, which cripple the individual's effectiveness; and the psychosomatic medical disorders, whose effects magnify the suffering attendant upon so much of physical illness. All of these disorders result from varying degrees of disturbance in either bodily structure or function, in psychological or social adjustment, or in the interpersonal relationships of human beings.

The psychoses

The most serious mental disorders are the psychoses, which may be acute or chronic illnesses, requiring hospitalization and treatment ranging from a few months to a lifetime of care in some cases. Some of these illnesses are the result of organic brain damage caused by accident, epileptic seizures, infectious diseases such as encephalitis and advanced cases of syphilis, or aging and degeneration of the central nervous system. The senile dementias—psychoses of older persons whose brains have been irreversibly damaged by cerebral arteriosclerosis and other conditions that come with advancing age—are in this category.

Schizophrenia forms the hard core of chronic mental illnesses. It is a disease which takes its greatest toll among young people and withdraws them from normal life frequently for long periods of years.

The other major psychoses include involutional melancholia, an illness which afflicts many women and some men in their middle years; the manic-depressive psychoses; and the paranoid states, in which

delusional fears predominate. Serious and disabling personality disturbances characterize all the psychoses.

The psychoneuroses

Phychoneuroses—the milder forms of mental illness—do not ordinarily require hospitalization, but they may be severe enough to prevent the individual from holding a job and fulfilling the normal requirements of family life. In less severe cases, the individual's inability to make a satisfactory adjustment may be manifested severely only in periods of crisis when new situations or responsibilities arise—taking on a new job, becoming a parent, entering college, adjusting to a physical disability. The unhappiness the psychoneurotic suffers, and the misery he frequently inflicts on the people with whom he lives and works, is no less real because this disorder appears to have no physical cause. The psychoneuroses seem to have their roots in cultural, social, and economic factors, such as disturbed family situations in childhood, and conflicts between individual needs and community demands.

Mental deficiencies

The mentally deficient group is characterized not so much by strange or troublesome behavior as by simple behavior. They are the people who, because of intellectual deficit, are, generally speaking, unable to keep up with the rest of us. At one end of the scale are those whose handicap is so great that institutionalization is required; at the other end are individuals who can hold jobs, manage their own affairs, and lead socially useful lives. All along the range between these two extremes are the mentally deficient who have varying levels of potential ability that can be developed with proper training.

Some of the mental deficiencies are a result of injury to the brain during birth or some later accident. Some children are born deficient because the mother contracted German measles during the early period of pregnancy, or because there are blood incompatibilities between mother and child. For many types of mental deficiency, however, the cause is not yet known, although biochemical and metabolic studies seem to hold promise of providing some of the answers.

Personality disorders

Mental illness also encompasses those personality defects which result in social maladjustment evidenced by alcoholism and drug addiction, psychopathic criminal behavior, juvenile delinquency, failures in school and on the job, and chronic irresponsibility. On a less serious level, personality disorders evidence themselves in marital maladjustment, proneness to accident in the home, on the highway and in the factory, and generally difficult behavior which complicates ordinary human relations and results in needless suffering and ineffectual behavior.

Psychosomatic illness

In recent years it has been learned that emotional stress in certain types of people will produce distress in certain organs or groups of organs. Some people, for example, who are under great tension and keep the trouble to themselves may get ulcers.

Dr. George S. Stevenson of the National Association for Mental Health estimates that about 40 percent of the patients in general hos-

pitals have conditions complicated by unfortunate life experiences and inadequate handling of personal problems. In any bodily illness, psychological factors such as the patient's attitude toward his illness and worry about his family have a major effect on recovery. The rehabilitation of persons with severe physical handicaps often hinges upon their mental attitudes.

C. THE HUMAN AND ECONOMIC BURDEN OF MENTAL ILLNESS

Number of people affected

In terms of social destructiveness of self, family, and community, mental illness has no peer. Though it is not a major cause of death, the outlook for the victims is too often a lifetime of unhappy hospitalization.

Mental hospital data.—The number of mentally ill patients in the United States exceeds the number of patients suffering from any other type of serious illness. More than 50 percent of all hospital beds in this country are occupied by the mentally ill. Of the average daily patient load of 1,300,000 in all United States hospitals in 1951, 54 percent, or some 700,000 were mental patients. At the end of 1950 there were 577,000 resident patients, or 3.8 per 1,000 population in all long-term mental hospitals. This number has increased from 150,000, or 1.9 per 1,000 population, since 1903, the first year for which comparable data are available. Although our population has increased 14 percent since 1939, the number of patients in mental hospitals has increased by 17 percent.

Schizophrenia, or dementia praecox, constitutes one of the largest groups of hospitalized patients. "There are over 100,000 people admitted for the first time to State mental hospitals in a year, of which about 25,000 have schizophrenia," stated Dr. Francis J. Braceland, psychiatrist in chief of the Hartford, Conn., Institute of Living.

Senile and arteriosclerotic patients—those suffering from what are called the mental diseases of the senium—now constitute about 27 percent of all first admissions to mental hospitals. The number of mental patients 60 years of age and over has increased by 58 percent since 1939, although the general population increase in this age group since 1939 has only been 25 percent.

These figures, however, do not give the total picture of mental illness. There are at least 153 general hospitals with facilities for diagnosis and treatment of psychiatric disorders. In addition, we do not know, although we suspect the number is indeed large, how many people suffering from mental illness never reach a hospital—because of the lack of available bed space, because of ignorance about the need for or prejudice against hospitalization, or because of inadequate diagnostic facilities.

Mentally deficient.—Between 1 and 2 percent of the population—in excess of 2 million people—are mentally subnormal. At the end of 1950 there were 134,123 resident patients, or 89.3 per 100,000 population, in institutions for mental defectives and epileptics. This represents an increase of more than 10 percent from the rate of 78.8 in 1941.

Selective Service and Armed Forces data.—Of the 4.8 million draft rejections during World War II, 18 percent—1 in every 5—was for mental ill health. A study of a selected sample of registrants between

the ages of 18 and 44 who were examined during 1940–43 revealed that mental illness was the sixth most common defect. The prevalence rate of mental illness in this group was 55.8 per 1,000.

Forty-three percent of the 1 million disability discharges from the Armed Forces during World War II were for neuropsychiatric reasons. The next largest cause for discharge was under 12 percent.

Others affected.—The results of two intensive mental-health surveys—one in Baltimore, Md., and the other in Williamson County, Tenn.—indicate that at least 6 percent of the total population suffer from a serious mental disorder. This is a total of 9 million people. Mr. Charles Schlaifer, cochairman of the National Mental Health Committee, cited studies which estimate that 1 in every 12 children born in the United States today is destined to spend at least a part of his life in a mental hospital.

Conservative estimates indicate that approximately 50 percent of all patients treated by general practitioners have psychiatric complications. In addition, Dr. Sanford, executive secretary of the American Psychological Association, has stated that the number of people whose lives are crippled by personality disorders is perhaps 20 to 50 times larger than the half-million hospitalized mental patients.

A nation's burden

The financial burden of serious mental illness is in most cases too great for any one individual or family. When a patient enters a mental hospital, the financial burden falls on all of the taxpayers. Ninety-six percent of all hospitalized mental patients are in tax-supported hospitals.

The direct cost of caring for the mentally ill in public hospitals and for pensions to afflicted veterans is more than $1 billion each year. Approximately 40 percent of the Federal budget for health care is for mental health, and in many States up to one-third of the total operating budget goes for care of the mentally ill. This cost is increasing at the rate of $100 million each year and there is no end in sight. Dr. Robert H. Felix, Director of the National Institute of Mental Health, pointed up these mounting costs graphically when he stated, "If the present birthrate remains constant, if the number of mentally ill who are hospitalized remains constant, and if the cost for hospitalizing the mentally ill remains constant, each year's crop of new babies will, because of the percentage of them who will go to mental hospitals, cost the taxpayers—this is just the taxpayer and not any private foundation—$800 million before they die."

The indirect costs of mental illness are many times greater. Loss of earnings while the patient is hospitalized, loss of taxes on these earnings, loss of production, social-welfare payments, and cost of caring for children of mentally ill parents swell the cost to several billion dollars a year.

Loss in productivity.—A study conducted by Dr. Benjamin Malzberg, director of the bureau of statistics, New York State Department of Mental Hygiene, showed that the average loss in productive man-years of labor is 8.3 for each person mentally ill enough to require hospitalization. Based on conservative estimates, this amounts to a loss of $10,000 in productivity per case, or well over 5 billions for those currently hospitalized.

Public assistance payments.—Eleven percent of the 93,000 persons receiving aid to the permanently and totally disabled during 1951 were mentally ill or mentally deficient. Based on this proportion and an increased caseload of 173,000 in 1953, current payments for public assistance to the mentally ill who do not require hospitalization amount to about $880,000 per month.

Of all recipients of old-age assistance, about 2 percent—some 50,000—require considerable care because of their mental condition.

Loss to the Armed Forces.—Draft and Armed Forces statistics during World War II show that more than 2½ million men were lost to the Nation's armed strength because of mental and emotional illness and defect—enough men for 177 Army infantry divisions.

Deaths.—Though mental illness is not a killer, it must be held responsible for the majority of the 17,000 suicides that take place in our country each year. Homicides and murders committed by the mentally deranged increase the death toll that must be charged against mental illness.

Other costs of care.—The foregoing figures do not include the time and manpower involved in the thousands of psychiatrists, clinical psychologists, psychiatric nurses, psychiatric social workers, and public-health mental-health personnel engaged in the treatment and care of the mentally and emotionally ill in hospitals, clinics, and private practice. They do not include the time and money spent by private physicians and by the staffs in general hospitals in the treatment of psychosomatic disorders, such as certain types of ulcers, arthritis, and heart disease.

No total picture of the burden of mental illness can be accurate unless one adds the time and services of the courts and our penal system in dealing with the psychopathic personalities who are responsible for a sizable proportion of crime and delinquency. The losses suffered by society in dealing with the effects of drug addiction, chronic alcoholism, and emotional disorders which result in divorces and broken homes are literally incalculable—both in terms of money and wasted manpower. To these must be added the loss represented by the services of health personnel, school people, welfare workers, rehabilitation workers, and countless other public functionaries who must cope with the results of emotional disorders. Industry, too, suffers grave losses from the chronic absentee, the chronic alcoholic, the accident-prone individual, the "troublemaker" who disrupts normal production—all of these people whose difficulties are directly traceable to mental and emotional disorders.

The burden on the individual

Because mental illness is a long-term disease and because the cost of adequate care is high, few individuals have the resources to pay for prolonged treatment. Short-term care in general hospitals is as costly as care for any other illness. Private psychiatric treatment is expensive, since the psychiatrist can see only one person in an hour's time. For all of these reasons, virtual family bankruptcy is an inevitable concomitant of mental illness. In addition, the very conservative estimate of $10,000 loss in earning capacity per case, as cited above, means further depletion of family resources. Financial worries make inroads into the mental health of the patient's relatives, and create

added burdens of worry which interfere with the patient's chances of recovery.

"Health insurance programs as they exist today," Dr. S. Bernard Wortis, who served as chairman of the panel of participants at the hearings, stated, "do not cover the cost of mental illness. No one of them does." The burden therefore falls on the family, the community, and the country at large.

In mental illness, medical indigence is not a matter of money alone. For most of the geographical area of our country, lack of enough trained psychiatric personnel and shortages of hospital beds and clinic services mean that thousands of citizens—no matter how much money they have in the bank—are deprived of desperately needed treatment and care.

D. THE NATIONAL ATTACK ON MENTAL ILLNESS

Current knowledge about the mental illnesses indicates that when the causes are discovered, they will be found to consist of many components—physiological, biochemical, psychological, socioenvironmental, etc. For this reason the efforts of a wide variety of research and professional personnel are being utilized in the attack on mental illness. In modern hospital care, there is no dividing line between what basic physical sciences, clinical services, and the social sciences can contribute. All disciplines must be involved to provide the skills required for diagnosis, treatment, cure, rehabilitation, education, and prevention.

The facilities and resources of government—Federal, State, and local; of professional societies of psychiatrists, psychologists, nurses, social workers, and others whose interests bear a relation to the field of mental health; and of voluntary citizens' organizations are being mobilized to assist in the study, treatment, and cure of mental illnesses.

Efforts have been channeled into four major categories:

1. Research into the causes and more effective treatment of mental illnesses. About $6 million a year is spent on research. Of this, approximately $4 million comes from the Federal Government, half a million from private sources and foundations, and $1½ million from State sources.

2. Training of additional psychiatric manpower to provide more adequate treatment in hospitals, outpatient clinics, other community agencies, and private practice.

3. Expansion of community facilities for diagnosis and early treatment of mental and emotional disorders.

4. Psychiatric orientation of professional people and public functionaries so that they can detect and deal with early signs of emotional disorders in the people with whom they come in contact. Closely allied to this effort is a broad program of public education designed to alert all our citizens to the problems of mental and emotional illness, and to indicate the need for early treatment and the resources available for such treatment.

The role of the citizens' organizations

National Association for Mental Health.—This is a national citizens' organization concerned with improvement in the care of the mentally ill and deficient, in the prevention of mental disorders, and

in the advancement of mental health. Founded in 1909, the National Association for Mental Health has affiliated with it 29 State and more than 200 local mental health associations, and it is a member of the World Federation for Mental Health. For the past 18 years it has supported extensive research on schizophrenia, and it has also devoted research funds to the study of psychosomatic disorders. The association engages in widespread public education work. It is currently laying the foundation for a national fund-raising campaign which it is hoped will overcome the handicap of inadequate financing which has always hampered its activities.

Other organizations.—The many State and local mental health societies are doing notable work in the field of public education and in providing supportive services that enable the mental hospitals and clinics to do a more effective job.

The National Mental Health Committee is an educational group of citizens and psychiatrists whose aim is to promote research and training in the field of mental health. Its membership includes many State governors and prominent individuals from public life and industry and commerce.

The role of the professional societies

American Psychiatric Association.—The leading organization in its field, the American Psychiatric Association is comprised of 7,700 psychiatrists, more than half of whom are diplomates of the American Board of Psychiatry and Neurology. It is a nonprofit scientific and educational association, deriving its funds from dues and special project grants from foundations and Government agencies. Its objectives are to further studies of the nature, cause, treatment, and prevention of mental disorders; to improve standards for the care and treatment of the mentally ill; to further psychiatric education and research; to make psychiatric knowledge useful to other branches of medicine, to other sciences, and to public welfare. The association publishes the American Journal of Psychiatry and numerous books and reports. It is responsible for inspecting and rating mental hospitals in the United States and Canada, and operates the Mental Hospital Service—a clearinghouse for technical information for the hospitals. For the past 12 years, the association has been responsible for accrediting and rating all schools of nursing in mental hospitals in the United States and Canada. It is currently undertaking a study of mental hospital architecture and equipment.

American Psychological Association.—This is a scientific and professional organization whose purpose is to advance psychology as a science, a profession, and a means of promoting human welfare. The American Psychological Association publishes 10 scientific journals which are financed through subscriptions. Its other activities are financed by dues from more than 12,000 members, 60 percent of whom possess the Ph. D. degree in psychology. The remaining 40 percent have the M. A. degree or its equivalent.

Almost half of the membership are clinical psychologists, the psychologists who are most directly concerned with mental illness. About half of these are connected with colleges and universities, and the remainder are engaged in research or service in nonacademic settings. The principal contribution of the psychologist in the field of mental illness is in research.

Other professional societies.—The Association for Research in Nervous and Mental Diseases includes neurologists, psychiatrists, and basic research scientists whose interests are primarily in the field of research.

The American Orthopsychiatric Association is composed of representatives of all the psychiatric disciplines whose major interests are in the field of clinical services and preventive work.

The American Association of Psychiatric Social Workers, the American Nurses' Association, the mental health sections of the Council of State Governments, the American Medical Association and the State and Territorial Health Officers Association, and the American Public Health Association are all vitally interested in dealing with the problems of mental illness and, within the sphere of their activities, in promoting mental health.

Psychiatrists in private practice

Up until 25 years ago, there were almost no psychiatrists in private practice. A recent study showed that there are now 4,000 in private practice, but that almost 3,000 are in cities of over 100,000 population. The shortage is due both to lack of training facilities and to the long and expensive training involved—3 years of special training in addition to the 9 years of college, medical school, and internship. Traineeships in psychiatry under the National Mental Health Act have helped to increase the number of physicians entering this field during the past 6 years. It has been estimated that psychiatrists in private practice treat about 800,000 patients each year for mental disorders of all types. Some combine their office practice with hospital practice, service to industry, schools, and courts, and teaching positions in medical schools. Improvements in the teaching of psychiatry to medical students in the past 10 years have prepared the physician who is not a specialist in psychiatry to treat more adequately patients with less severe mental disorders.

The role of the States and local communities

Since 1773, the States have assumed responsibility for the care of the mentally ill who require hospitalization. This medical care program alone now costs the States more than $500 million a year. But it has been only within the past 10 years that all States have developed departments for the promotion of mental health and the prevention of mental illness. Administrative responsibility for this function is vested in the department of health in 32 States, in the department of welfare or other agencies in 12 States, and in a separate department of mental hygiene in 9 States. As yet, only 19 States have a full-time staff with one or more representatives of each of the psychiatric disciplines.

In its role of consultation and leadership, the State mental health staffs provide inservice training and set standards for professional personnel. They assist local communities in the development of mental health programs, conduct public education activities, and provide psychiatric orientation for teachers, general physicians, and other professional personnel who have contact with large numbers of people in their daily work.

Besides programs in schools and community projects in such special areas as alcoholism, drug addiction, mental deficiency, and aging, over

1,000 mental health clinics are in operation. Some of these local clinics are separate facilities and some are affiliated with medical schools, hospitals, courts, or schools. Their functions include (*a*) outpatient diagnosis and treatment, (*b*) consultation to physicians and local agencies such as courts and schools, (*c*) mental health education, (*d*) training for mental health personnel, and (*e*) clinical research. Clinics are supported by private sources such as Community Chest or by local, State, or Federal public funds. Patients treated in the clinics are those whose illness does not require hospitalization, those who would require hospitalization if the clinic services were not available, and those who have been discharged from mental hospitals. Some clinics treat only children or adults, or only veterans, or other special groups. Many States have set up separate clinic facilities for alcoholics, and 40 States and the District of Columbia operate programs of public education, treatment, and rehabilitation in the field of alcoholism.

Other activities of State mental health agencies include studies to identify the mental health needs in the particular State and to evaluate the effectiveness of programs in operation.

The role of the Federal Government

The National Institute of Mental Health, Public Health Service, Department of Health, Education, and Welfare, under authority granted by Congress in the National Mental Health Act of 1946, acts as a coordinating and research stimulating center to speed acquisition of new knowledge and to expedite more effective application of existing knowledge through the country. It engages in laboratory and clinical research, assists in developing preventive and treatment programs, and administers grant programs which support research in mental illness, training of psychiatric personnel, and establishment and expansion of community mental health services.

Research.—Based on the thesis that progress in the diagnosis and treatment of nervous and mental diseases rests firmly on basic understanding of the nervous system through the biological and behavioral sciences, the research conducted by the National Institute of Mental Health attempts to encompass all of the relevant disciplines.

Funds appropriated by Congress support grants for research which are awarded by the Surgeon General of the Public Health Service upon recommendation of the National Advisory Mental Health Council, composed of 12 nongovernment leaders in medicine, the fundamental sciences, and public affairs. The 203 projects supported in the 6 years since grants were first awarded under the National Mental Health Act have utilized psychological, social science, biological, chemical, pharmacological, psychiatric treatment, and interdisciplinary research methods in the search for more knowledge about the causes and treatment of mental disorders.

In addition, postdoctoral research fellowships in psychiatry, neurology, neurophysiology, biochemistry, and the social sciences have been awarded to 183 scientists to enable them to receive training in research techniques.

Epidemiological and biometric research.—The Institute assists the States in the collection and compilation of accurate, adequate, and consistent statistical data on mental disorders—an essential but as yet unrealized objective.

Epidemiological studies conducted by the Institute are attempting to pinpoint the differences, in terms of background, life experience, between the mentally ill and normal individuals, and to explore the factors in family relationships which are most conducive to the rehabilitation of hospitalized mental patients.

Increasing the reservoir of psychiatric manpower.—Grants administered by the Institute are expanding and improving the psychiatric training programs at universities, hospitals, and other training centers. 15,000 of the 27,000 undergraduate medical students during fiscal year 1952–53 were able to obtain training in the basic principles of psychiatry through these grants. Similarly, from 25 to 80 percent of the individuals taking graduate training in psychiatry, clinical psychology, psychiatric nursing, psychiatric social work, and public health mental health benefited in improved training, from these grants. Individual traineeships are also made available to graduate students in these professions, so that qualified personnel, who might not otherwise be able, can be trained to work in the mental health field.

Community services.—The Institute staff and consultants in the departmental regional offices provide the States with technical assistance in the development of statewide and local mental health programs.

Under the National Mental Health Act, grants are made to the States on a matching basis for the development of mental health services outside of hospitals and institutions.

New horizons.—The Institute has begun exploratory studies to develop mental health programs in such important areas as mental deficiency, juvenile delinquency, and rehabilitation of the mentally ill, which hitherto have been neglected because of insufficient knowledge about techniques and procedures, or lack of understanding of the significant mental health implications of those fields.

E. PROGRESS AGAINST MENTAL ILLNESS

Research

Though mental disease is probably the most complicated and obscure problem faced by medical science today, appreciable strides have been made as a result of fundamental and clinical research. With the discovery that paresis, an organic brain disease, is caused by syphilis, it was possible to institute control measures. Today, with improved methods of prevention and cure, the number of paretics has been reduced to a bare minimum. Similarly, pellagra, an illness which formerly accounted for about 10 percent of the hospitalized mental patients in some Southern States, has come under control since it was discovered to be due to a nutritional deficiency. Today there are very few cases of pellagra, and these can be treated simply and effectively.

Development of the electroencephalograph to record electrical activity of the brain has improved the diagnosis of many epilepsies. New drugs, new surgical techniques, and new psychotherapeutic methods are proving successful in the treatment of these disorders.

Although mental deficiency has proved resistant to medical research, some forms can be prevented. We have learned, for example, that mothers must not be exposed to German measles during the

first 3 months of pregnancy. And by total transfusions of the newborn we can prevent mental deficiencies due to incompatible RH factors in the blood of mother and child.

Considerable advances have been made in our knowledge of the serious mental illnesses of senility, the category that accounts for 27 percent of first admissions to State hospitals. Here we have learned that loss of status and of real meaning in life is as significant a factor as arteriosclerotic changes caused by deficient blood circulation to the brain. Recent years have seen the rapid development of psychosomatic medicine. We have discovered that many illnesses of childhood and adult life, hitherto obscure, are caused or largely influenced by emotional factors, and thus have been enabled to treat them more effectively. The use of shock therapies had made it possible to cure the bulk of patients with involutional psychoses in less than a year.

Despite these advances, the cause and effective treatment of most of the mental illnesses and behavior disorders are still the subject of vigorous investigation on a broad front of laboratory and clinical research.

Biological studies.—Research is being conducted which will provide better understanding of the nervous system and the nature of mental illness. Through the use of infrared, ultraviolet, X-ray, and electron microscopy, we are learning more about the structure of the nervous system. Newly devised techniques are being used to measure the circulation and metabolism of the living brain in health and disease. These techniques have yielded information on the senile psychoses, on the effects of various organic brain diseases, and on the usefulness of a number of drugs and surgical procedures designed to correct these conditions.

Refined techniques are making it possible to study the electrical activity of single cells in the brain and spinal cord, and to chart the patterns of electrical activity over the surface of the brain. We are thus gaining valuable information about the functions of the brain which are bound up with the basis of normal and abnormal thinking.

In the field of schizophrenia, the costliest of all illnesses, it has been discovered that the cause is not due to deficient circulation of blood and oxygen to the brain. New drugs which produce symptoms in normal persons similar to those exhibited by schizophrenics are being used to investigate the biochemical and physiological nature of schizophrenia. Recent studies have shown important relationships between the endocrine system—especially the adrenal glands—and schizophrenia, a significant contribution to the diagnosis and treatment of that disease.

Social and cultural factors in mental illness.—It is not yet known whether the stresses and tensions of everyday life are the cause of mental illness or merely precipitating factors. There are wide divergencies in types of mental illness found in populations with different ways of life, but no society is free of mental illness, especially schizophrenia. In our country, studies have shown that schizophrenia requiring hospitalization is much commoner among lower income than higher income groups, and that patients from lower income groups are more likely to experience prolonged hospital care. A series of epidemiological studies is now under way to discover whether schizophrenics are produced by the social setting characteristic of lower

income groups, or whether they drift into these settings because of inadequacies produced by personality disorders.

Other studies are aimed at (*a*) Improvement of public education programs which will motivate more people in need to seek early treatment for mental and emotional disorders; (*b*) Improvement of treatment procedures and patient-staff relations in mental hospitals designed to speed recovery and rehabilitation of mental patients; and (*c*) Discovery of the significant social factors which lead to juvenile drug addiction.

Psychological studies.—Many studies have shown that psychological factors, particularly damaging emotional experiences in early childhood, are of extreme significance in the cause of mental illness. Research on various phases of child development have helped determine the types of mental illness which first manifest themselves in abnormal child behavior. A great deal has been learned about the disturbed relationships which contribute to or cause this abnormal behavior.

Recent animal experimental studies have demonstrated the effects of anxiety on learning, and of the great distortions in perception caused by prolonged frustration and conflict of motives. We are beginning to understand how life experience affects physiological processes and the body's biochemistry, and how these in turn further affect behavior.

Psychotherapy is the most widely used therapy in the treatment of mental illness and emotional disorders. It is almost the exclusive treatment for the neuroses and the emotional maladjustments of children, and has proved successful with many schizophrenics. Studies are being conducted to evaluate the reasons for its effectiveness, and to determine its usefulness in other types of illness. Group psychotherapy, in which 5 or 10 patients discuss one another's problems under the leadership of a trained therapist, has proved an effective and economical method of treatment for many types of emotional disorders.

In addition, psychological studies, based on the results of interviews, tests, and observation of behavior, are bringing new and more effective methods of rapid diagnosis of mental disorders.

Surgical methods.—Psychosurgical techniques appear to have resulted in the improvement of a moderate number of chronic mental patients in various mental hospitals.

Total push.—The statement submitted by the American Psychiatric Association indicates that, if hospitals have the personnel and facilities, a total push technique which employs all the presently known therapies can speed the recovery of mental patients considerably. The technique involves the use of psychotherapy, group therapy, occupational therapy, carefully designed ward activities, educational programs, and recreation. Although the total push treatment is admittedly expensive, its effectiveness in promoting early recovery makes it economical in reducing the number of patients who must be cared for over a long period of years. The technique has proved effective with many schizophrenics and even with many of the "back-ward" or so-called hopeless patients.

Alcoholism and drug addiction.—Increased understanding of the physiological changes in bodily organs as a result of alcoholism and narcotic drug addiction is making it possible for us to treat these conditions more successfully.

Mental deficiencies.—The establishment of research centers in many States and the progress in classifying patients who respond to certain types of treatment hold hope for progress in the hitherto hopeless and tragic area of the mental deficiencies. Recent studies have indicated that Mongolian idiocy is produced not by heredity, but by some physiological accident occurring in the mother about the 6th week of pregnancy.

Hospital administration.—A study of mental-hospital architecture and design being conducted by the American Psychiatric Association is bringing to light new facts about hospital administration which will result in benefits to mental patients. Application of a new concept which views the mental hospital as part of a network of community psychiatric services—with the hospital the last resort if other defenses fail—is helping to speed the practical application of new research findings, and to increase the number of people who can be kept out of hospitals through treatment in outpatient facilities.

Increased training of psychiatric manpower

There has been a marked increase in the number of psychiatrists since the time the National Mental Health Act was passed. There are now about 8,000 members of the American Psychiatric Association. More than 4,000 have been certified by the American Board of Psychiatry and Neurology; in 1946 there were fewer than 1,000.

In the past 5 years the Federal program has provided funds for the training of some 2,200 to 2,300 psychiatrists, clinical psychologists, psychiatric nurses, and psychiatric social workers. Dr. Wortis pointed out that nearly 70 percent of these have entered public service. Grants made to 117 graduate training centers have improved the training available to many more thousands of persons entering the psychiatric professions. In addition, grants to 42 medical schools have enabled these institutions to develop good teaching programs for the medical student in the field of psychiatric and psychosomatic disorders.

The fellowship program of the National Institute of Mental Health has enabled 183 promising young scientists to develop their mental health research skills. Some of these fellows are now conducting or participating in significant research projects in the field.

Federal grants have also enabled professional organizations such as the American Psychiatric Association, the American Psychological Association, and the American Association of Psychiatric Social Workers, to conduct conferences at which leaders in professional education can work out problems of curriculum improvement. These conferences have had a significant impact in modifying teaching so that trainees will be better prepared to deal with the problems of mental illness when they enter professional practice.

Increased State and local activities

The States have recently taken a great deal of interest in the promotion of mental health. The period between 1948 and 1952 was marked by an increased mental hospital building program. Dr. Richard Willey, formerly research associate for the Council of State Governments and currently executive assistant for the American Psychological Association, informed the committee that the Governors Conference is sponsoring a national conference of representatives of all State mental health agencies. In addition, he stated,

some of the States have increased their budgets for mental health considerably and have taken initiative in expanding research and training programs.

Increased State and local financial support of mental health activities is apparent in the amount of money made available to match Federal mental health grants. The formula requires 50 cents of State money for each Federal dollar allocated. In 1953 figures presented by Dr. Felix showed the States were matching each Federal dollar allocated with $3. In the period from 1947 to 1953, the $17 million of Federal grants were matched by more than $43 million of State, local, and private funds.

When the Mental Health Act was passed in 1946, only 24 States had mental health programs in addition to the State mental hospital system. Today, given the impetus of Federal funds and the technical assistance of the National Institute of Mental Health, all of the States, the District of Columbia, and the Territories have going programs. Major credit for this great advance in such a short time must be given to aroused public concern and increased public interest. In the vanguard of non-Federal agencies that have contributed to the improvement of mental hospitals and the expansion of psychiatric services are the American Psychiatric Association, the American Psychological Association, the National Association for Mental Health, and the Conference of State Governors.

Clinic and other services

The number of psychiatric clinics in the United States increased from 1,040 to 1,154 between 1948 and 1952. This increase is larger than it seems, since only 263 were full-time clinics in 1948 as against 484 in 1952. Our present services are equivalent to 760 full-time clinics but, based on the fact that a clinic cannot serve more than a population of 100,000, we still need 840 more. The improvement that has occurred thus far is in large part due to the energy with which the States have developed their mental health programs. In addition, the stimulus provided by National Mental Health Act funds have made possible the establishment of 200 new clinics and the expansion of services by 200 other clinics.

In the past 5 years many larger communities have established or expanded the following types of mental health services: Psychiatric hospitals or psychiatric wards in general hospitals, mental health clinics for children and adults; consultation services to schools, courts, and social agencies; public education to increase the application of mental health principles in family life and industry; and alcoholism prevention and rehabilitation programs. As yet, however, no community has all of the services it needs and, of course, the smaller communities are able to afford practically none of these needed facilities.

Services for the mentally subnormal

Recent studies have shown that with adequate educational, social, and vocational services, the majority of those whose mental subnormality is mild can find and keep jobs. Only a very small beginning has been made in this direction, and the needs are still great.

Residential institutions are providing services for only about 5 percent of the mentally subnormal, and their long waiting lists point up the need for more such services.

Rehabilitation services

Progress in rehabilitation of the mentally ill has been somewhat slower than in rehabilitation of the physically handicapped. However, despite the great shortages of needed personnel from the fields of medicine, social work, psychology, education, and employment, significant progress has been made in the past 3 years. Stimulated by the direction furnished by the National Institute of Mental Health and the Office of Vocational Rehabilitation, and aided by the technical assistance of the regional mental health consultants, many States and local communities have developed inservice training programs for vocational rehabilitation counselors, and a number of such counselors have been assigned to work with mental patients on a full-time basis. In addition, pilot projects have pointed up the contributions that the public health nurse and the public welfare worker can make in helping the mental patient return to a productive life in his community.

Public education and control work

The increase in and expansion of State and local mental health programs has been accompanied by greater emphasis on and activity in preventive and control work. To promote better utilization of current psychiatric knowledge, education programs are being carried on which give parents, teachers, physicians, nurses, social workers, court officials, industrial counselors, and religious leaders a better understanding of human relations and human behavior. These services are paying off in prompt handling of emotional problems before they develop into serious disorders, and in speedier recognition and referral for early psychiatric treatment of those children and adults whose behavior indicates emotional illness.

In addition, State, National, and international voluntary citizens' organizations provide consultant services, study the mental health needs that must be met, support the production of all types of public educational materials, and encourage public support for increased research, training, and community services.

Selected examples of progress in mental health

1. Approximately 40 to 60 percent of persons suffering with schizophrenia can be helped by modern treatment methods (Dr. S. Bernard Wortis).

2. A generation ago, two-thirds of the patients with involutional melancholia were considered hopeless. Today, two-thirds of these patients are discharged from the mental hospital within 1 year of admission (Dr. Francis J. Braceland).

3. Recent studies in a State hospital in Stockton, Calif., showed that intensive treatment can triple the chronic mental patient's chances of recovery (Dr. S. Bernard Wortis).

4. Some of the best-manned mental hospitals are able to discharge from 60 to 70 percent of their patients within the first 3 months. Another 10 or 15 percent get out within a year (Dr. Daniel Blain, medical director of the American Psychiatric Association).

5. Due to improved psychiatric techniques, two-thirds of the mental breakdown cases during the Korean campaign were rehabilitated and returned to duty without leaving the division. Only 4 percent had to be returned to the United States for treatment. This is a dramatic improvement over World War II when 8 percent were evacuated to the zone of interior, and over World War I when 15 percent were in this seriously disturbed category (Dr. S. Bernard Wortis).

6. Since the establishment of a 13-bed psychiatric ward in a general hospital in Savannah, Ga., commitments to the State mental hospital from that county have been cut 58 percent. (Statement submitted by the National Mental Health Committee.)

7. The day hospital, a new type of treatment center, is bringing care to more patients at half the cost. Selected mental patients who are too ill for outpatient treatment but do not need 24-hour care attend the hospital from 9 a. m. to 5 p. m. and sleep home at night. (Statement submitted by the National Mental Health Committee.)

F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

Present needs for research

The needs in this area are highlighted by the statement, contained in the report submitted to the committee by the National Institute of Mental Health, that "a program of research in the problems of mental disease must be broad enough to encompass all the important areas which may contribute to our understanding." We dare not overlook any area in which an answer or a clue may be found, whether it be biochemistry, physiology, or the sciences of animal behavior and human relations.

We need to learn more about where the different mental diseases occur, what their incidence is, and the geographic and environmental factors with which they are associated. This type of knowledge has helped uncover the causes of other illnesses, and it is essential in evaluating the effectiveness of current preventive techniques.

Better criteria for diagnosis of the various mental diseases are needed. This involves study of normal and abnormal behavior, development of tests for the rapid identification of those who are likely to become mentally ill, and research into the pathology, physiology, and biochemistry of individual mental diseases.

The important relationships between mind and body, as evidenced in psychosomatic illnesses and the psychological problems of physical diseases, must be further probed.

We need to develop our knowledge, through the basic sciences, of all phases of the structure, growth, and functioning of the brain, and the nervous system. And more work must be done in human and experimental psychology to better understand the mental processes involved in mental and emotional illnesses, and to evaluate and improve our therapeutic tools.

Some major unknowns in mental illness

The following list, extracted from the statement submitted to the committee by the American Psychiatric Association, indicates some of the more important areas in which progress must go forward:

1. Specific causes of the major mental illnesses, particularly schizophrenia, manic-depressive psychosis, and paranoia.

2. The social, economic, and cultural factors underlying mental illness; specifically, the part played by present-day tensions and modern ways of living and working in causing mental illness.

3. Comparative data about the manifestations of mental illness in various other countries, as a means of further understanding the complexities of the psychoses and the neuroses.

4. Effective techniques for use in preventive psychiatry, which must be based on basic research findings about the causes of mental illness.

5. Educational methods that will be successful in sustaining public interest in the problems of mental illness, so that rapid fluctuations in public and financial support will not undo the benefits derived during a period of high interest.

6. Understanding about psychopathic character disorders which result in criminal behavior and juvenile delinquency.

Need for more trained manpower

Although the training sponsored under the National Mental Health Act is increasing the reservoir of trained personnel to conduct needed research and treatment, the shortages of trained manpower in the mental health field are still drastic. In 1953, for example, there was only 1 clinical psychologist for each 1,000 patients in State mental hospitals. Minimum standards recommended by the American Psychiatric Association call for 1 clinical psychologist for each 100 patients for initial intensive treatment, and 1 for each 500 patients for continual treatment service.

There are only about 8,000 psychiatrists in the United States; the American Psychiatric Association estimates there is immediate need for at least 15,000. It will be at least a decade before we can reach this number. Similar shortages exist for psychiatric nurses and psychiatric social workers.

One of the difficulties in attracting competent people to the psychiatric professions is the fact that salaries in this field are generally lower than in the older and better established natural science fields. If the mental health field is to compete successfully for research skills it must be able to offer salaries comparable to those offered by other fields for similar work, and it must provide facilities for the young researcher to develop his skills. A young man or woman interested in research will not be attracted to a position at an institution unless he is given the opportunity to learn and grow in an atmosphere where research and communication with other colleagues is encouraged.

Another problem is related to current selective-service procedures, as stated in the report of the American Psychological Association. The Government, recognizing the need for scientists, invests in their training through scholarship and fellowship programs. The Government and the military need scientists. "But selective-service steps in to stop the training of scientists, often just as the period of usefulness is about to begin."

Need for more funds for research

Only about $4.75 per mental patient is now being spent on psychiatric research. This compares with $28.20 for polio, and $27.70 for cancer. These figures, contained in the report submitted by the American Psychiatric Association, indicate that the total amount available is out of all proportion to the importance of mental illnesses.

This report further states that, although there is a shortage of trained manpower to do psychiatric research, we have an as yet untapped reservoir of practicing psychiatrists who are capable of doing research. The only way to uncover more personnel and attract them to research in this field is to make more financial support available.

Current methods of allotting funds for psychiatric research suffer from three major defects, as noted in the statements prepared for the committee by the American Psychiatric Association and the American Psychological Association:

1. Present methods of allotting a given amount of money to a particular project for a limited amount of time—usually 1 year—give the research workers no assurance that the project will be continued if more time is needed. In the field of psychiatry especially, long-

term research is required, research in which the investigators have the opportunity to develop whole fields of investigation rather than limited projects.

2. Federally sponsored research projects are not provided funds for the publication of scientific findings in professional journals. "Research depends on communication * * * scientists need to exchange ideas if knowledge is to be cumulative." The failure to publish the results of research in established scientific journals "leads to unnecessary and unproductive duplication of research." (Statement submitted by the American Psychological Association.)

3. For similar reasons, the drastic cuts in Government travel funds, which make it impossible for Government scientists to attend and participate in scientific and technical meetings, is a "very dubious long-term economy." To force scientists to work in social isolation is, in effect, to emasculate science.

The amount now spent yearly on psychiatric research is around $6 million. If it were to jump to 13 or 30 million or more it would be a small figure indeed to gamble on an all-out effort to empty the mental hospitals of America. (Statement submitted by the American Psychiatric Association.)

NEED TO IMPROVE STATE HOSPITALS

State mental hospitals in many localities are now spending less than $2 per day for the care of mental patients. This compares with $16 per day for city hospitals and $20 per day for private hospitals. The average per capita expenditure in State institutions for mental defectives and epileptics is slightly over $2 per day. "Therefore, you can see the type of care which might be given to these patients," concluded Dr. Francis J. Braceland.

Although State mental hospital building programs have progressed, inadequate staffs make the quality of care poor, indeed. In many cases, Dr. George S. Stevenson pointed out, new hospitals become overcrowded soon after they are opened, and patients soon are crowded into utility and maintenance spaces.

Based on minimum standards developed by the American Psychiatric Association, in order to have proper patient-staff ratio for effective treatment in our mental hospitals, we need twice as many psychiatrists as we now have, 4 times as many psychiatric nurses and psychiatric social workers, 8 times as many occupational therapists, and many more psychiatric aids or attendants. No mental hospital today—not even the federally operated St. Elizabeths Hospital, which is one of the most outstanding mental hospitals in the whole world—meets these minimum standards.

Following a thorough study of the mental health programs of all 48 States, the Council of State Governments made the following recommendations for the improvement of State hospital programs:

1. More hospital space for the care and treatment of the mentally ill is urgently needed.

2. A large part of scientific and medical equipment and facilities is antiquated. Modern equipment and facilities are needed.

3. More professional personnel are needed, and especial attention should be given to the training of attendants.

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4. Statewide programs should be devised to deal more adequately with psychiatric needs for observation, care, and treatment of mentally ill children. These programs should be coordinated with the services of social and child welfare agencies, health agencies, schools, and churches.

5. Studies should be made and plans developed for the care of special categories—the mentally deficient, the chronic alcoholics, the drug addicts, the persistent sex deviates.

Need for more public understanding

Mental illness is a massive problem. Because so little about it was known to science until comparatively recently, and because there is so much general ignorance about its true nature on the part of the general public, the whole field of mental health is often looked upon with suspicion and fear. There is too great a tendency on the part of people in general to try to shut the problem of mental illness out of their awareness—a feeling, as Dr. Felix described it, "that if you forget about mental illness and ignore it, it will go away." We are, in essence, confronted with a major mental health problem which cripples our efforts to attack the problem of mental illness. For legislators, whether they be on the Federal or State level, cannot move too far ahead of their constituency in providing leadership in this field. "They cannot keep on sticking their necks out" in support of mental health research, training, and treatment services, said Dr. George S. Stevenson, "unless there is public backing."

The unwillingness of the general public to meet the realities of mental illness brings with it "unwillingness * * * to accept treatment, to support the mental hospitals, to comfort those who are ill, to give employment to those who have recovered from mental illness * * * better public education accompanied by scientific advances are gradually overcoming public indifferences, but the problem remains a vast one." (Statement submitted to the committee by the American Psychiatric Association.)

Needs in State and local mental health programs

On the State and local level, Dr. Wortis stated, "more community service clinics, guidance centers, and psychiatric services in local general hospitals" are needed, "for in the earliest recognition and treatment of mental ill health we have the best method of preventing serious and chronic mental illness."

Other immediate needs are to maintain leadership in State mental health agencies by retaining present staff and by filling vacancies with trained professional personnel. Every State needs more research personnel to analyze mental health needs and evaluate existing programs. Every State administration is also aware of the need to improve methods of rehabilitating the mentally ill in order to conserve manpower, reduce human suffering, and cut down on the burdensome budget for care of the mentally ill.

Information made available to the National Institute of Mental Health indicates that the major needs of communities in developing their mental health resources are: (*a*) more funds, (*b*) more personnel to provide clinical, consultation, and educational services, and (*c*) knowledge of current, better, and more economical methods of providing mental health services that have been developed in other com-

munities or through research. Because of failure to meet these needs, many communities have been unable to establish mental health services, and many others have not been able to continue services once established.

Needs in services for the mentally deficient

In addition to the pressing need for research into all aspects of mental subnormality, there is great need for more training to provide the necessary personnel needed for health, education, social, and vocational services to the mentally defective. Although the number of residents in public institutions for the mentally defective increased by 24 percent from 1940 to 1950, the number of teaching personnel increased by only 9 percent.

Another great need is for field projects to explore and evaluate new ways to provide comprehensive services for the mentally subnormal on a community-wide scale. In all of these areas, the National Institute of Mental Health, together with other allied government, public, and private agencies, can make a major contribution, provided adequate financial resources are made available.

Needs in the field of rehabilitation

Further encouragement needs to be given to cooperation between mental hospitals, mental health clinics, vocational rehabilitation agencies, and other community resources in providing comprehensive rehabilitation services for the mentally ill. More training to provide needed personnel and more inservice training of staff already on the job are also needed.

More field studies and investigations must be carried on to give us the knowledge that will help keep former mental patients healthy and reduce the number of readmissions. More needs to be known about foster home care for discharged patients, and about effective techniques for supervision of such patients in their own families.

Recommendations of the Council of State Governments

Perhaps the best method of summarizing the ways in which we can strengthen our attack on mental illness is to list some of the more significant recommendations made by the Council of State Governments following an exhaustive study of training and research in State mental health programs. These recommendations were incorporated in the statement submitted to the committee by that organization.

1. More facilities for the recognition and early treatment of mental illnesses which do not require hospitalization. Promotion of mental health outside State hospitals—utilizing increased resources in mental health clinics, child guidance centers, schools, welfare agencies, and other community institutions.

2. Better treatment methods, more positive means of prevention, and a larger number of persons competently trained to put them into effect. "Training and research are primary hopes for eventual reduction of admissions to mental hospitals."

3. More systematized and coordinated administration of State training and research programs.

4. More communication and coordination of activities among State mental hospitals, university research centers, professional training schools, and community-treatment services. This will help bring the

hospitals into the mainstream of research activity, improve training, and prevent duplication of research effort.

5. Continued improvement of hospital and clinic reporting systems and development of uniform data through cooperation with the United States Public Health Service.

6. To overcome grave personnel shortages, increased encouragement of graduate and undergraduate students to enter "professions immediately concerned with psychiatric treatment and also in the basic biologic and social sciences which affect progress in mental health."

7. Provision of more inservice training and opportunities for research for staffs in mental hospitals and clinics.

8. Provision of more stipends and better salary scales to overcome the difficulties of the high cost of professional education and the relatively low-salary scales in public psychiatric employment.

9. Closer integration of mental hospitals with other community resources for mental health.

10. Scientific evaluation of the effectiveness of early treatment provided by mental health clinics and child-guidance centers.

11. Encouragement of fundamental research in the biological and social sciences to provide the basis on which applied research can operate to seek practical solutions to immediate problems.

12. Encouragement of interstate cooperation in the support of research, training, and mental health services.

The States and local communities are aware of their responsibilities in the national struggle against mental illness. The problem, however, is too large and complex to be dealt with on an individual State level. Support, encouragement, integration, and direction are sought and must be forthcoming from the Federal Government if current gaps in the national mental health efforts are to be closed.

The hope that mental illness can be conquered

The fundamental causes of the major mental illnesses are not yet known. They may arise, as Dr. Seymour S. Kety, Associate Director in Charge of Research, National Institute of Mental Health, sums it up, "in a very broad spectrum, from the anatomy of the brain to the psychological experiences of the child and throughout his life." We are now at the threshold of great advances in knowledge of the physical and chemical structure of the brain, for we now have the tools with which to attack these problems. We already have techniques which will enable us to explore the metabolism and living development of the brain, and have made progress in understanding the function of hitherto obscure areas of the brain. The sciences of behavior, human and experimental psychology, are beginning to yield information about the mental processes involved in neuroses and psychoses, and to offer means of testing the effectiveness of current treatments.

Hope lies in continuation and expansion of the present trend to concentrate on an interdisciplinary attack, including in the research team the neurologist, the physiologist, the physiological psychologist, the sociologist, and the anthropologist, as well as the psychiatrist and the clinical psychologist. For, as Dr. Kety pointed out:

> The basic scientist, by constant experience and constant contact with mentally ill patients and with people treating the mentally ill, is constantly stimulated to devote his research energies to these important problems.

Research that helps us understand the human being will benefit not only the mentally ill but also the potentially ill and the millions of people who now live, because of emotional problems, far below their best level of effectiveness. (From statement submitted by the American Psychological Association.)

Hope lies in increased financial support of mental hospitals and research centers, in the attraction of an increasing number of gifted people to the field of mental health research, and in the provision of increased and more adequate facilities in which research can be conducted. If our national expenditure for the care of the mentally ill were doubled, Dr. Sanford stated, we would increase our budget by $1 billion. If our national research effort were doubled, he pointed out, the increase would be only $6 million, or about half of 1 percent. And yet this small increase would be a most profitable long-term investment in bringing new knowledge about the causes and more effective treatment of mental illness which might drastically reduce the far larger cost of care under the present state of knowledge.

Another area of hope lies in the progress that has already begun in increasing the psychiatric manpower to treat the mentally ill and promote sound mental health in all our people. Much more needs to be done here; much more support and more inducements must be offered to help train the thousands of professional psychiatric personnel so desperately needed.

Hope lies also in the beginnings made toward integrated State and community mental health programs, which in the past two decades have brought preventive services and early treatment to thousands more of the emotionally disturbed. More and more of these services need to be provided, especially in those parts of the country where sparse population and geographical factors have so far deprived these regions of the benefits science has already brought. If there is not sufficient motivation in the financial and humanitarian benefits expansion of such services can bring, we should remember that, at our present stage in world history, we cannot afford to have a citizenry debilitated by the ravages of mental illness and the personal and social ineffectiveness produced by emotional disorders. In a very real sense, hope for progress in the field of mental health is inextricably intertwined with continued fulfillment of the American way of life.

And it is only through the typical American way of self-help and local initiative, of the combined efforts and cooperation of Government and private resources, that mental illness will eventually be conquered. For though the catastrophic nature of mental disorders makes it impossible for any organization besides the State and Federal Governments to handle the bulk of the hospitalized mentally ill, the system suffers from lack of personnel, lack of incentives, insufficient rewards for accomplishment, lagging research, and uneven spurts of public interest and support. Great progress is being made today. Much greater progress will be made, the American Psychiatric Association assures us, if the total forces available, both public and private, are increased to provide a more extensive effort. A beginning has been made under the activities carried out by the National Institute of Mental Health since the passage of the National Mental Health Act in 1946. This effort must be encouraged and expanded. With the Government providing the impetus and coordination, needed research, training, and community mental health services can continue to progress on all levels, bringing new victories in the battle against mental illness.

CHAPTER VII

NEUROLOGICAL AND SENSORY DISORDERS

A. SUMMARY

A review of the problems presented by the neurological and sensory disorders gives us only a partial picture. Because of their variety and their unfamiliarity, much of the testimony on these diseases was devoted to definitions of disease entities and the functions of the agencies concerned with them and, consequently, their significance to the Nation and our modes of attacking them was never brought into sharp focus. It is also apparent that precise information concerning this group of disorders is not available, and this is understandable in view of the fact that public and private attention has been concentrated on these problems only within the past several years. Only in the presentations on blindness, where private health agencies have been functioning on a broad scale for the past 2 decades, were accurate statistics offered and substantiated on the basis of objective survey.

Nevertheless, the testimony on the neurological and sensory disorders was of considerable value. Professional and informed estimates and opinions, buttressed by fragmentary but firm data, do give us a broad understanding of the problems involved and provide a sound basis for further exploration. Such exploration should be initiated as soon as possible, if only because sound concepts of the problems must partially guide future actions in meeting them. It is also clear from the testimony that insufficient funds have hitherto blocked efforts in this direction and that, in any case, certain needs are presently so insistent as to have obvious priority.

The chief need in this field seems to be research, and it is interesting to note that even those voluntary health agencies primarily concerned with the aid and welfare of patients (especially those servicing the blind) have also insisted on this emphasis. The recognition of this need seems to derive from several reasons: It has become apparent that it is financially impossible to provide the needed medical and welfare services to the huge patient load afflicted by the neurological and sensory disorders. In view of the fact that no cures exist for these conditions, medical aid and care do not in any case resolve the problems, so that the rehabilitated blind still remain blind, the rehabilitated cerebral palsied, multiple sclerotic, and epileptic still remain crippled. Moreover, within the past decade, it is apparent that research on the complexities of the nervous system has made important forward strides, and there is good reason to hopefully believe that research can prove extremely fruitful within the near future.

In spite of the recognition that research has high or even highest priority, an important dilemma is still posed for the various voluntary health agencies concerned with the neurological and sensory

disorders. The services for the blind and the cerebral palsied, for example, are unquestionably useful and extension of these services to provide a minimum of independence and dignity for a maximum number of victims is clearly necessary. The ability to divert a large proportion of voluntary health-agency funds to research, therefore, is limited, and, in fact, the total research attack on these problems is extremely small considering their extraordinary burden to the Nation.

To bolster the research attack on the neurological and sensory disorders, private voluntary agencies are now looking to the Federal Government and are urging further support of the recently constituted National Institute of Neurological Diseases and Blindness of the Public Health Service. The establishment of this Institute by Congress in 1951 has already made possible important contribution to research in the field. The Institute presently supports about 25 to 30 percent of the scientific investigations directly or indirectly concerned with these problems.

That future progress must lie with an intensified research attack, in which both public and private agencies participate more actively than ever before, is quite clear. The urgency of such an attack is fully recognized by the Government; the personal tragedy of the neurological and sensory disorders and the severe economic burden they place on the Nation, involving losses in the neighborhood of $10 billion yearly, makes it imperative that their resolution be found in the shortest possible time.

B. WHAT ARE THE NEUROLOGICAL AND SENSORY DISORDERS

The concept of the neurological and sensory disorders as a single entity was a relatively new one for the committee. Such problems as cerebral palsy, epilepsy, multiple sclerosis, muscular dystrophy, blindness, and deafness had been conceived of as separate conditions. These disorders, however, are apparently all linked by their reference to the central nervous system, to the brain, the spinal cord, the nerves, and the sensory receptors which provide the powers of sight and hearing. It was clear from the testimony that this concept of a unified group of disorders was accepted by the various voluntary health organizations concerned with the individual health problems and that the Public Health Service's National Institute of Neurological Diseases and Blindness symbolized that unity.

While unified as a group by reference to the nervous system, the variety of damage caused by the more than 200 disease entities concerned seems to be considerable. As a generality, however, these disorders all more or less affect either the powers of movement, speech, vision, hearing, or consciousness, and in some cases several of these functions together. With but few exceptions, the causes for these disabilities are unknown, though it is apparently recognized that irrevocable destruction of nerve tissue is a central problem and if nerve tissue could be regenerated this would provide a resolution for several of the major neurological disorders.

C. THE HUMAN AND ECONOMIC BURDEN OF THESE DISORDERS

While the testimony did not, except in a few instances, produce verifiable statistics obtained by survey, it was clear that these disorders present a major public health problem. It was estimated that

some 20 million persons suffer the neurological and sensory disorders, of whom at least half endured gravely disabling conditions. As a cause of death, these disorders rank third, and they are considered the leading cause of permanent crippling. No cures apparently exist for many of these maladies; a few, namely epilepsy, Parkinsonism, myasthenia gravis, cataracts, and glaucoma are partially or temporarily controllable, but for the great majority only palliative treatment seems possible.

Though the data presented were fragmentary, the picture of the national economic losses due to the neurological and sensory disorders was an exceedingly grave one. The costs considered during the hearings included the costs of medical care and welfare, wage and productivity losses, indemnity and compensation costs, and tax revenue losses, and these would seem to total somewhere close to $10 billion a year.

This staggering figure was understandable in the light of the nature of these disorders. Affecting the vital organs as they do, they eliminate the patient from acting as a productive member of society, and because so many of these conditions initiate in either childhood or early adulthood, yet frequently run their course through the entire normal life span, the economic losses are continuous.

The testimony produced few statistics which could completely clarify the economic burden imposed by any one of the neurological and sensory conditions. The most useful figures were given in relation to head injuries suffered as a result of industrial and automobile accidents. These injuries cause wage losses amounting to $624 million yearly, with an estimated $600 million more for costs of medical care, welfare and compensation payments, and another $1.2 billion to include productivity losses, loss of materials, damage and repairs to machinery, tools, and materials, loss of time by other employees, executives, and medical personnel. The total losses due to head injuries alone thereby amount to $2.4 billion annually and these figures are almost a decade old.

On the basis of these statistics, simple multiplication might indicate that all neurological disorders would cost the Nation close to $30 or $40 billion annually. Some of these costs, however, can be eliminated in other areas. Compensation and productivity costs only exist where the disorder occurs as a result of employment accidents and only a minority of cases, therefore, would include these expenses. It should be noted, however, that many instances of blindness, deafness, and paraplegia are due to such accidents and that the costs of compensation are especially high. As estimated by one insurance company, the cost of indemnity and hospitalization of a single paraplegic patient throughout his lifetime will amount to $400 thousand. There are from 85,000 to 125,000 paraplegics in the country, with a large number having incurred the disability by accident in peace or war.

The costs of medical care and welfare are less than losses due to enforced unemployment or limited productivity, but these are significantly high also. The care and welfare of the blind costs the Federal and State Government and the various voluntary health agencies $150 million yearly, and this does not include personal expenditures. The hospitalization of 50,000 epileptics in State institutions amounts to $35 million annually, and this does not include such other services as are

rendered to a majority of the remaining 1,450,000 persons afflicted with seizure.

It is apparent that large numbers of those who suffer the neurological and sensory disorders cannot receive medical treatment, care, or welfare due to the paucity of either specialized personnel or specialized facilities. While on the one hand this would seem to eliminate certain costs, on the other it creates a situation whereby members of the patient's family must devote their full or partial attention to the victim and thereby reduce the family productivity even further.

Personal losses are in part correlative with national losses, and the impoverishment of families with relatives suffering the neurological and sensory disorders is apparently not infrequent. The costs of the various types of disability will, of course, differ; and differences also occur within each type of disability depending on the severity of the condition and the normal variation of service charges. Care and rehabilitation costs for the cerebral palsied will vary during a lifetime between $10,000 and $100,000. Just the education of a baby who has been born blind will vary between $50,000 and $100,000.

Because no cures or specific treatments exist for most of these disorders, it might be expected in these cases that medical costs would be virtually eliminated. The testimony revealed the fact that most patients were unwilling to accept the inevitability of their condition and apparently many records exist of patients making fruitless pilgrimage from physician to physician until finally all funds are exhausted.

Certain neurological conditions, moreover, are apparently difficult to diagnose; multiple sclerosis and myasthenia gravis are not exposed as such for an average of 6 years after these disorders have occurred. Such patients may be treated for a variety of ailments during this period without success but at a considerable financial sacrifice.

These economic costs are just part of the stress which bears so heavily on the patient and his family. The removal of the disabled patient from all the ordinary activities of life commits the family as well to isolation, and it would seem to be true that only "the profoundest love can salvage the splintering of the most intimate ties."

D. THE NATIONAL ATTACK AGAINST THESE DISEASES

The efforts to provide care for the victims of the neurological and sensory disorders vary considerably. Within the past few years, several major problems, such as multiple sclerosis, muscular dystrophy and myasthenia gravis, have received the benefit of public aid through voluntary health agencies established for this purpose. The various States with the assistance of the Federal Government have also contributed in some measure, but by and large, with the exception of the cerebral palsied and the blind, it seems apparent that only a few services can be made available to the barest minimum of those suffering these conditions.

It is also clear that even the cerebral palsied and the blind are not obtaining nearly adequate aid. Public assistance for the blind from both governmental and private sources presently averages about $100 monthly for each blind person. While probably no other group of disabled persons as a group receive such high benefits, the total disability created by loss of vision and the necessity for long, specialized

training to help the blind obtain some degree of independent self-care makes this sum a marginal one.

This obtains even more so for cerebral palsy. The testimony clarifies this situation very well by describing the cerebral palsied program in Connecticut, a State which apparently is and has been aware of the needs of the cerebral palsied for some time.

According to State authorities in 1951, of 420 children who needed occupational therapy, only 60 received it; of 580 children needing physical therapy services, only 220 had been served; speech therapy was needed by 260, 70 received it; less than half of those needing extensive treatment given in special hospitals could obtain it, and for every child then in a custodial institution, there was at least 1 more for whom such care was desirable. Another 120 children needed special educational classes; 30 needed a home-instruction program and there was considerable need for further vocational guidance services, medical social work and paramedical support.

The State of Connecticut, moreover, pointed out that these statistics were based only on the known cases of cerebral palsy. But for every 10 cases that were known, the State acknowledged that 7 were not.

The supply of services to all sufferers from the neurological and sensory disorders clearly depends on adequate funds and this includes funds not only for the direct aid of the sufferer but also to subsidize the building of facilities and the training of personnel by which such aid might be applied.

The training of personnel to administer medical and paramedical aid to those suffering the neurological and sensory diseases receives the support of the voluntary health agencies and the Federal Government, but it is evident that the supply so obtained cannot by any means meet the demand. The testimony indicates that the number of specialists capable of diagnosing and treating the neurological disorders is extraordinarily low. Of the more than 190,000 practicing physicians in the country, less than 250 specialize in medical disorders of the nervous system. In some areas of the country, there is only 1 such specialist to over 900,000 persons in the population, and the best ratio sees only 1 per 650,000. There are, for example, 5,000 registered and practicing physical therapists in the Nation, and there are 2,500 vacancies presently, with an additional 5,000 needed within the next 5 years. Such therapists, of course, are also required for the rehabilitation of other than neurological patients.

The reflection of this situation on the care of patients afflicted with the neurological and sensory conditions has already been indicated. Even where treatment or rehabilitation is feasible, in short, treatment or rehabilitation may be impossible. Of the almost 2 million victims of cerebral vascular disease (stroke), only a fraction receive rehabilitation. Of the 1½ million epileptics, only 300,000 receive treatment.

Within the past several years there has been apparent recognition that research would have to have the main priority in the attack on the neurological and sensory disorders. It has apparently become clear that while medical and welfare services can still be increased, the financial requirements for supporting the entire patient load of 20 million persons could never be achieved. In view of the fact that no cures exist for these conditions and only palliative treatment, it is recognized that medical and welfare services alone do not help halt the perpetuation of these problems. Moreover, within the past decade, research on

the nervous system has made important strides forward, and there is now for the first time good reason to believe that research can prove extremely fruitful within the near future.

Within the past few years, then, there have been clear signs of increasing research activity in the attack on the neurological and sensory disorders. In fiscal year 1951 the National Institute of Neurological Diseases and Blindness was established by Congress, and since that time the various voluntary health agencies have increasingly devoted more funds to the support of medical research. To coordinate their research efforts as separate agencies, and to stimulate research further from both public and private sources, the major voluntary health organizations joined together in 1952 to form the National Committee for Research in Neurological Disorders, and in 1953 the leading organizations for the blind similarly combined for the same purpose to form the National Committee for Research in Eye Diseases and Disabilities.

In spite of the recognition that research has high or even the highest priority, an important dilemma is posed for the voluntary health agencies. The services they provide the patient are unquestionably useful, and extension of these services to provide a minimum of independence and dignity for a maximum number of victims is clearly necessary. Their ability to divert a large proportion of their funds to research is therefore limited.

These agencies now feel they must look to the Federal Government to significantly bolster the research attack on the neurological and sensory disorders and are urging further support of the recently constituted National Institute of Neurological Diseases and Blindness.

E. PROGRESS AGAINST THIS GROUP OF DISEASES

That future progress lies with an intensified research attack may be accepted on the basis of past progress which has been achieved within a short period of time and with minimum funds. The testimony reveals that just during the past decade several remarkable achievements have been made which have either directly alleviated some of the burden of suffering or promise further alleviation in the near future. These achievements have been made over the period of the past decade at an average research cost of approximately $2 million yearly.

New drugs and new surgical procedures have apparently been evolved whereby 80 percent of all epileptic seizures can be controlled; new drugs have been found to alleviate the muscular weakness of myasthenia gravis and partially control the symptoms of Parkinsonism; and the development of new rehabilitation procedures has helped restore the cerebral palsied to some measure of independent self-care. Progress in eye research has also been considerable. ACTH and cortisone have been responsible for preventing blindness from a variety of disturbances; new surgical procedures and new drugs have helped retard the insidious progress of these conditions; and the development of corneal transplant methods has been able to restore sight in some cases where it would have been irrevocably lost.

Many basic studies were mentioned during the testimony where findings though not of immediate application to illness promise that such application may be made in the future. The committee was especially interested in the devolopments made in the regeneration of

nerve tissue, where it is apparent that if such regeneration can become possible in humans a large number of these disabling disorders may be eliminated as major problems.

The testimony revealed that partial regeneration of nerve tissue had been achieved with experimental animals. Cats whose spinal cords had been severed were administered a "dead heat-producing bacterial agent," and this agent apparently prevented the formation of scar tissue at the point of severance, thereby allowing the nerve ends to grow together.

While the discovery, the discussants revealed, was extraordinary in view of the long and widely held belief that nerve tissue could never be regenerated, they cautioned against overoptimism. The agent has not proved useful in the treatment of human disorders where nerve tissue has been destroyed (such as cerebral palsy, epilepsy, and multiple sclerosis). It seems likely that before a successful therapy is devised, considerably more must be learned about the biochemistry and metabolism of nerve tissue.

In spite of these achievements, the testimony made it clear that in the full perspective of the problems to be faced only a fraction of the questions posed have been answered. Most of the major disorders, such as cerebral palsy, multiple sclerosis, muscular dystrophy, epilepsy and Parkinsonism remain incurable. In this regard it was especially noted that treatments controlling the disorders were in many instances of dubious consequence, that only cures would be able to eliminate that prejudice which is the fate of the epileptic, the cerebral palsied, the multiple sclerotic and others whose deranged movements create considerable public aversion. The fate of the epileptic was especially emphasized, for though 80 percent of seizures may be partially or wholly controlled, even the possibility of seizure militates against the employment of the adult epileptic or the education of the child epileptic.

F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

The primary problems revealed by the testimony seemed to lie with the need for further research and further research manpower. It was clear on the basis of funds allocated by the National Institute of Neurological Diseases to the support of various disease categories that some major areas were being neglected. These especially included cerebral vascular disease, deafness and blindness. With a budget of four and a half million for fiscal year 1953, the Institute could apparently devote relatively large sums to a few significant problems, but many conditions among the 200 or more disease entities which constitute its responsibility could receive no support whatsoever. The sum of $18 million annually was broached on questioning as the sum which could usefully be put to work at the present time to bring the Institute's research attack to its optimum level of effectiveness.

The precise nature of the research to be undertaken in any given disorder was not clearly defined. For all disorders, however, it was apparent that a much deeper understanding of the growth, activity and functions of the spinal cord and especially the brain was of utmost importance. The entire nervous system, inaccessible as it is to direct study, and the great complexity of the brain, which is composed of

some 20 billion nerve cells, each serving a separate function, makes this research one of the major medical challenges of our time.

The problem of laboratory research manpower is apparently not a major one in this field. The number of applications for research grants made of both the voluntary health agencies and the National Institute of Neurological Diseases and Blindness far exceeds their power to pay them. The lack of neurologists and ophthalmologists in the country, however, and the inadequate facilities for training them creates an important problem for research development. It is to the practicing physician that the public must look for the development of research findings made in the laboratory and to their application to human illness. Without them, the work of the laboratory scientist in the scientific journals gathers dust on the library shelves. The fact that only 23 of the Nation's medical schools have complete neurological units for teaching physicians and scientists is already a serious problem in delaying the development of new therapies. As research in the laboratory becomes even more productive, this situation will probably worsen.

No concrete recommendations for the development of services for the victims of the neurological and sensory disorders was presented during the testimony. As has been mentioned, the problem seems overwhelming, and even with a large increase in public and private expenditures, it would seem impossible to meet more than a fraction of the responsibilities inherent in all these problems. The needs of the disabled do not stop with medical aid and welfare, but include specialized employment, recreational, social, and psychological provisions. This problem, of course, serves to emphasize the further need for productive research.

In spite of the fact that the attack on the neurological and sensory disorders is still at an early stage, the testimony revealed a good degree of optimism. The progress in research during a relatively short period of time and the consistently increased funds available for scientific investigation held considerable promise for the future. While the burden of providing services for those disabled by these conditions seemed staggering, the increase of public support for these purposes during the past 2 or 3 years suggests that with further research developments it may be possible to provide at least minimum aid for all. In consideration of this possibility, however, the committee is aware that it listened only to those agencies which represented sufferers of the major neurological conditions and that there are many others who have no such representation and whose welfare, therefore, may, perhaps, be a matter of deeper concern.

CHAPTER VIII

ARTHRITIS AND RHEUMATISM

A. SUMMARY

Representatives of the three national organizations and others primarily concerned in the conduct of the attack on arthritis and rheumatism in the United States met with the Committee on Interstate and Foreign Commerce in Washingon on October 5, 1953, to discuss their problems with the members of the committee, and to advise them generally concerning their programs.

From the prepared statements submitted by participants, and from the discussions and answers to questions, the committee learned that:

Arthritis, with its related rheumatic diseases, afflicts, cripples, and disables more people than any other chronic disease—more than 10 million persons in the United States, of which more than a million are permanently disabled. The economic cost of arthritis and rheumatism is more than $700 million per year.

There are many different types of rheumatic diseases: Rheumatoid arthritis, osteoarthritis, nonarticular rheumatism, gout, rheumatic fever, and the collagen diseases, such as scleroderma.

After centuries of neglect as a stepchild of medicine, arthritis and rheumatism, within the past 5 years, have become recognized as a major health problem about which something must be done. In the past 5 years, more progress has been made against these diseases than in hundreds of preceding years.

The discovery of the beneficial effects of cortisone, ACTH, and other hormones in arthritis not only provided a means of controlling many cases, but has pointed out new pathways for research, from which experts confidently expect great results.

Although tremendous strides have been made in research and in providing for patient care, still less than 1 percent of arthritis victims can obtain necessary hospital care. The costs of treatment for the protracted course of the rheumatic diseases often impoverishes the victim and makes him dependent upon others.

A major problem is trained manpower. Less than 800 doctors in the United States are especially competent or interested in the treatment of the rheumatic diseases; primary stumbling block to setting up more arthritis clinics (there are only 230 in the entire country, none in 14 States) is finding doctors willing and able to handle the job. The manpower problem also is felt in the absence of enough competent research workers relative to the importance of the disease. Well trained physiotherapists in this country are relatively scarce.

Major needs, as pointed up by the testimony, included increased facilities in the medical schools for teaching and training medical scientists at both the undergraduate and postgraduate levels; construction and equipment of laboratories and clinics at medical schools and hos-

pitals; continuance and expansion of research programs at medical institutions; added provisions for research fellowships and traineeships in the medical sciences and clinical specialties.

B. WHAT ARE ARTHRITIS AND RHEUMATISM?

Rheumatic disease is usually characterized by aches and pains in joints and muscles, often resulting in stiffening and swelling of affected joints. This family of diseases is composed of several members, each with its own distinctive character. First and foremost is rheumatoid arthritis, perhaps the cruelest of them all. It is a chronic disease that frequently lasts a lifetime. It is a crippler, for which there is no known cause or cure.

Another of these diseases is osteoarthritis, otherwise known as degenerative joint disease. This type results largely from aging and from wear and tear of the joint structures. It afflicts people past middle age. It occurs in multiple joints and in the spine with greater or lesser symptoms in all persons who live long enough. There is, as yet, no effective means of arresting or retarding this degenerative process in the joints.

Another group of rheumatic victims suffer from nonarticular rheumatism, or disorders of the muscles, bursae, ligaments, tendons, or other tissues.

Others who are afflicted with rheumatic disease suffer from types of arthritis due to rheumatic fever, gout (gouty arthritis), injury or infection.

Finally, there is a group of serious and often fatal disorders known as collagen diseases (lupus erythematosus disseminatus, polyarteritis nodosa, scleroderma). In these cases the connective tissue which constitutes the supporting structures or framework of the body is attacked, inflamed and often destroyed. The cause is unknown and the cure is yet undiscovered.

Rheumatoid arthritis.—Rheumatoid arthritis is a disease which occurs most often in persons between the ages of 18 and 45, although it strikes people of all ages: children, people in the prime of life, and the aged, all of whom are potential victims, potential cripples. It involves not only weight-bearing joints but joints of the hands and arms as well. It is a disease with widespread involvement in the body. The patient with rheumatoid arthritis usually has swollen, inflamed joints which are deformed. The disease process is not limited to the joints. It involves the muscles, nerves and small arteries. In some instances the heart is attacked and recent research has discovered previously unrecognized rheumatoid heart disease. The basic process in all these instances is one of chronic inflammation which is initiated by injury to the connective tissue by a noxious agent as yet unidentified.

Osteoarthritis.—This form of arthritis, is seen more often in persons who are past middle age. It is generally regarded as a manifestation of aging resulting from wear and tear on the joints. More than 80 percent of the persons in this Nation who are past the age of 50 have osteoarthritis in some degree. Osteoarthritis occurs usually in weight-bearing joints, and in general is not accompanied by systemic manifestations. This disease is as old as mankind itself. Pathological changes characteristic of this disease have been observed

in skeletons of prehistoric dinosaurs of over 200 million years ago. Definite degenerative joint disease has been noted also in Egyptian mummies and in prehistoric American Indian remains. The onset of osteoarthritis may be hastened and aggravated by strain, bruises and heavy or unusually tiring work. Chronic irritation or overburdening of the weight-bearing joints brought on by overweight or poor posture can and often does produce osteoarthritis.

Gout (gouty arthritis).—This disease is considered to be an inherited disorder. A distinct hereditary tendency has been noted. It occurs predominantly in males. It is usually characterized by acute and recurring attacks of severely painful arthritis and frequently results in severe crippling. Gout also is one of the oldest known diseases. It was described as early as the fifth century B. C. by Hippocrates. Most frequent affected joints are those of the great toes (bunion joints). Next in order of frequency are other joints of the feet, ankles, fingers and wrists. Gout is characterized by sudden acute attacks and by remissions which may be just as sudden and just as unexplainable. In the later stages urate deposits which often are painful and crippling are found in the affected joints.

Collagen diseases.—Contemporary concepts of the collagen diseases have been formulated only in the past 10 years. In this group are included rheumatoid arthritis, rheumatic fever, scleroderma, polyarteritis nodosa, lupus erythematosus, and dermatomyositis. The pathologic feature common to all of them is an abnormal structural change of the widely disseminated connective tissue, involving many organs. These diseases are usually serious and often fatal. The exact cause is unknown. In the last 2 years evidence has been collected to indicate that the administration of certain drugs may result in the development of at least three members of the group. (Note: Although rheumatoid arthritis is a collagen disease, it is, because of its importance, usually discussed as a separate item.)

C. THE HUMAN AND ECONOMIC BURDEN OF ARTHRITIS AND RHEUMATISM

Arthritis, and its related rheumatic diseases, is more prevalent among our citizens than are cancer, heart disease, tuberculosis and diabetes combined. In the United States today, it afflicts, cripples, and disables more people, and brings more pain to more persons than any other chronic disease. It disables 10 times as many patients as tuberculosis, 7 times as many as cancer.

The total number of victims, approximately 10 million, is greater than the combined populations of Chicago and Los Angeles. Of these 10 million victims approximately 1 million are permanently disabled. Among chronic diseases, rheumatism cripples the largest number of patients and kills the least. Because of its ability to cripple without killing, arthritis is of preeminent medical, economic, and social importance. Unfortunately, a large percentage of individuals affected by the rheumatic diseases receive no medical treatment, or treat themselves. In England, chronic rheumatic diseases cause one-sixth of the total invalidism of the insured population. It has been estimated that on a given day in this country about 1 person in each 1,000 develops a rheumatic disease. More than 320,000 otherwise able individuals are rendered unemployable in the United States for an entire year by rheumatic diseases.

The economic cost of arthritis and rheumatism to the Nation is well over $700 million per year. In the United States 30 million people—one-fifth of the population—counting the families of arthritics, are affected by the medical, social, and economic aspects of this problem. Over half a billion dollars yearly is lost in wages and salaries by sufferers from this disease in addition to the cost of medical care and relief allowances. Medical care, alone, costs more than $100 million per year. Arthritis brings with it not only pain and crippling, but impoverishment, to many of its victims.

The Federal Government loses each year $77 million in income taxes because of wage earners unable to work. The manpower lost each year in the United States because of arthritis and rheumatism is estimated as 150 million days, equivalent to an army of over 400,000 persons unable to work at any time.

Only about 1 percent of rheumatic patients get hospital care, and few of these can remain in the hospital long enough to receive much benefit. There are today in the United States 230 arthritis clinics, but the need for many more is urgent. During its brief existence, the Arthritis and Rheumatism Foundation has been responsible for the founding of nearly 80 new arthritis clinics within the past 2 years.

When arthritis, particularly rheumatoid arthritis, strikes in a family, the results can often be catastrophic, particularly if it is the wage earner who is afflicted. Rheumatoid arthritis strikes most often those persons who are in the most active phase of their life, at those who have family responsibilities. Rheumatoid arthritis is, as has been pointed out, a crippling disease, and quite often lasts a lifetime. Not every person who is stricken with arthritis becomes a helpless cripple, but many do. Even if the wage earner is not seriously or permanently crippled he will most likely lose many days from work, lose many days' wages, and will become a serious financial drain upon the family's resources. Even in cases successfully treated, with cortisone, for instance, the cost of medication alone, to keep the disease under control, may run from 50 cents to several dollars per day.

D. THE NATIONAL ATTACK ON ARTHRITIS

Early organization

The earliest attempt to do anything in an organized manner about arthritis in the United States dates back only to 1928, with the formation of the American Committee for the Control of Rheumatism. This committee worked actively to arouse the interest of the medical profession in the magnitude of the sociologic problem presented and to extend knowledge of the rheumatic diseases by means of publications and exhibits. By 1930 it was apparent that there should be a national society for the study and control of rheumatic diseases, and from this committee the American Rheumatism Association was founded. It was and remains a strictly professional organization of about 800 physicians with a special interest in the rheumatic diseases.

Just before the entry of the United States into World War II, a committee of the American Rheumatism Association was appointed to study the possibility of undertaking a national fund-raising effort to support research, teaching, and more adequate care of patients

with the rheumatic diseases. This important effort was delayed by the outbreak of hostilities, but after the end of the war rapid progress was made. Early in 1948, with the initiative and stimulation derived from the American Rheumatism Association, a separate organization, the Arthritis and Rheumatism Foundation was established, with a board composed of physicians and prominent, public-spirited laymen for the purpose of organizing an appeal for funds on both a national and local level.

Modern history: The past 5 years

With the establishment of the Arthritis and Rheumatism Foundation, fund raising for research, treatment, and education in rheumatic disease was initiated first on a nationwide scale in 1948. The public interest aroused by that first campaign, although something less than phenomenal, was encouraging.

In 1949 came the momentous discovery that cortisone, a hormone of the adrenal glands, would dramatically relieve arthritis, hitherto not associated with the metabolic system. ACTH, a pituitary hormone, was found to produce similar effects. Thus, new avenues of approach, more promising than any previously opened against rheumatic disease, were made available to medical research.

In 1950 months of careful study of the health needs of the country by the House Committee on Interstate and Foreign Commerce led to the passage, on August 15, of the Omnibus Medical Research Act, Public Law 692, authorizing establishment of the National Institute of Arthritis and Metabolic Diseases within the Public Health Service.

Thus it was that, late in 1950 at long last, a nationwide program was inaugurated that would permit an organized attack by the Federal Government and private citizens upon arthritis and rheumatic diseases. The new voluntary agency and the new Government agency have since worked together as a team, each complementing the efforts of the other. However, although the machinery has been forged, and although the field is broad and new pathways to the ultimate goal have been pointed out, it will obviously require more time, experience, and fiscal support to unlock the secrets hidden by these baffling diseases and begin to approach our goals.

Coordination and cooperation

Close working relationships have been developed among the three organizations primarily concerned with the national attack on arthritis. Constant liaison and consultation on matters of policy, program, and operation is maintained. The chairman of the Arthritis and Rheumatism Foundation is a member of the National Advisory Arthritis and Metabolic Diseases Council which guides the research grants program of the National Institute of Arthritis and Metabolic Diseases. Likewise, the Chief of the Arthritis and Rheumatism Branch of the Institute is a member of the Medical and Scientific Committee of the Arthritis and Rheumatism Foundation and of the executive committee of the American Rheumatism Association.

At the operating level, too, constant contact and interchange is maintained, and cooperative projects undertaken. For example, the Manual for Arthritis Clinics was written by medical experts of the Rheumatism Association, was published and distributed jointly by the foundation and the institute, and is being used as an important reference by medical schools.

As both the Institute and the foundation support research through grants-in-aid to scientists and maintain fellowship and traineeship programs, it is important, in the interests of efficient management, that these efforts be coordinated. Constant exchange of information, advice, and comment is maintained in this area, so that no important field of interest is overlooked, and yet no wasteful duplication occurs.

By maintaining continued coordinative and cooperative relationships, these organizations, representing the Federal Government, the medical profession, and the public's voluntary interests are able to work together against the common enemy—arthritis and the rheumatic diseases—most effectively.

The Arthritis and Rheumatism Foundation

As has already been pointed out, the Arthritis and Rheumatism Foundation was established in 1948. It is a nonprofit membership organization incorporated under the laws of New York State, and at the present time there are 35 chapters in 30 States, and 6 organizing committees.

The medical policies and medical program of the foundation are formulated principally by the medical and scientific committee of the national foundation. This committee consists of 17 outstanding American medical scientists working in the field of rheumatic diseases, including a key staff member of the National Institute of Arthritis and Metabolic Diseases.

The chapters are patterned very closely after the national foundation. Each chapter also has a medical and scientific committee and a board of directors.

The medical and scientific committee of the chapters on the local level is responsible for the local program.

The boards of directors of both the national and local levels are concerned with the business aspects of the chapters.

At present, the foundation has no endowment funds. It depends entirely on public subscriptions for its financial support.

The national foundation as such—that is, national headquarters—does not solicit funds directly. Practically all of its sources of income are derived from the chapters. The chapters raise the money. The national foundation supplies the personnel help and also material help in the form of various campaign materials to assist the chapters in raising this money.

The chapters retain 64 percent of the funds raised to carry on the local program; and 36 percent of the money is sent to national headquarters to conduct the national program. All moneys received directly at national headquarters from individual donors in chapter areas are treated in exactly the same way as if they were collected locally by the chapter; the chapter receives its 64 percent.

Complete financial returns from all the chapters are not available for the current year. These figures are based on the returns received to date, based on approximately $960,000 of funds reported.

Of that amount approximately $95,000 has been spent for public education, $306,000 for diagnostic services, therapy, care, and rehabilitation; $265,000 for research, both at the national and local level; and approximately $107,000 for administration.

Broken down on a percentage basis, the picture looks as follows: Approximately 10 percent is spent for public education on the na-

tional and local levels; 32 percent for diagnostic services, therapy, care, and rehabilitation; 27 percent for research; and 11 percent for administration.

Campaigns have been conducted for the past 5 years and have raised in the aggregate during that period approximately $4,729,000.

Foundation makes progress.—When the Arthritis and Rheumatism Foundation was established in 1948, the field of arthritis and rheumatism was practically virgin territory. Except for a handful of interested doctors and about as many clinics, little was being done to relieve the suffering of millions of arthritics across the Nation.

Today, 5 years later, because of the efforts of the Arthritis and Rheumatism Foundation and more recently of the National Institute of Arthritis and Metabolic Diseases, more has been done in the field of arthritis from the point of view of research and clinical advances than had been done in the previous 100 years.

Because of the continuous public education program carried on by the Arthritis and Rheumatism Foundation, the rheumatic diseases have become recognized as the Nation's leading chronic ailment. The foundation's program has caused communities to begin to weigh the economic waste that is attributed to arthritis and to begin to do something about the pain and misery that causes the loss of human worth. Industry, too, for the first time is beginning to count the annual toll of the millions of workdays lost to production, the loss of wages and purchasing power, and the loss of productive quality because of arthritis and rheumatism.

In 1948, when the Arthritis and Rheumatism Foundation was established, few of the 72 approved medical schools in the country at the time taught the rheumatic diseases with any degree of emphasis. The opportunities for graduates and undergraduates to study and work in the field of the rheumatic diseases were few. Among all the thousands of beds in the Nation's training hospitals, only about 700 were allocated to arthritis patients. Of this number only 65 were specifically endowed for the use of the thousands upon thousands of indigent persons afflicted with arthritis in need of hospital care.

Ninety-six new clinics.—Until 1948 there were only 134 arthritis clinics in the entire United States. Most of these were concentrated in eight large eastern cities. Fifteen States had no arthritis clinics at all. Since 1948, the Arthritis and Rheumatism Foundation through its various chapters has been instrumental in establishing 96 new arthritis clinics, 50 in the last year alone. However, there are still 14 States with no arthritis clinics at all and hardly any doctors there specially trained to treat persons afflicted with the disease.

In the 5 years the foundation has been in existence, there has been a perceptible kindling of interest among the medical schools of the Nation. In almost every school today located in an area serviced by 1 of the foundation's 35 chapters, the teaching of undergraduates in arthritis has been expanded and improved. With the help of chapter medical committees, these schools are offering refresher courses in the rheumatic diseases, to practicing physicians.

In the past 3 years, the foundation's national research program has been devoted to the support of young scientists working in the field of rheumatic diseases. Each year the money available has been increased. For the current fiscal year this support has been increased by nearly 40 percent with the awarding of 10 fellowships and 8 re-

newals for a total cost of $93,000. During the past 3 years, the foundation and its chapters have underwritten 150 research projects costing a total of $1,133,616.

Industry recognizes problem.—One of this year's most significant achievements was the alerting of industry to the arthritis problem. Some 200 industrial physicians attended the foundation's first conference on the rheumatic disorders in industry and techniques for keeping patients employable. Similar conferences have been planned for industrial physicians in various sections of the country.

In an effort to reduce industry's resistance to employing the handicapped, the foundation in New York has made grants to vocational-guidance and job-placement agencies who specialize in these problems. A similar project was launched in the Boston area for patients considered to have an unutilized capacity to work. In California, where there exists an acute shortage of physical therapists skilled in treating arthritis, special courses were arranged for nurses interested in physiotherapy.

Part of the foundation's efforts to control arthritis are the many publications prepared for the laymen and the medical profession. The Manual for Arthritis Clinics, issued in cooperation with the National Institute of Arthritis and Metabolic Diseases, was circulated to 4,062 doctors interested in improving arthritis clinics. The monthly bulletin on the rheumatic diseases, prepared by the Nation's leading rheumatologists and designed to keep doctors abreast of the newest advances in the field, is mailed regularly without charge to 19,000 doctors around the world. Home Care, a booklet designed to help the rehabilitation of arthritics, was first published in January of 1953. In the last 8 months, 70,000 of these Home Care booklets have been distributed to arthritis patients through their doctors. In the past 4 years the foundation has distributed several million pieces of literature to the lay public.

The magnitude of the problem at hand is noted particularly in the field of direct patient care. Though chapters of the foundation have been concentrating a good portion of their funds on the establishment of clinics and the expansion of existing clinic services, the need is far from met. Even in those areas where there are a number of arthritis clinics, there still is the problem of reaching sufferers living in outlying areas and of extending medical care to arthritics confined to their homes.

Home care programs.—To meet this need, 11 chapters of the foundation have launched home-care programs. A number of chapters maintain fully equipped mobile units that are staffed by physical therapists and which provide bedridden or homebound patients with much of the same rehabilitation therapy they would obtain in a clinic. Several chapters are providing the same home-care service through the cooperation of local visiting nurses who have been trained by the chapter to care for arthritics. Home-care programs have helped speed the recovery and the rehabilitation of arthritis sufferers by making possible the repeated use of corrective exercises under the guidance of a member of the family. Home care also takes treatment directly to the bedside of patients who cannot afford extensive hospitalization. This helps reduce the heavy load at clinics, thereby leaving the facilities available for patients whose conditions require the immediate attention of physicians.

With the Arthritis and Rheumatism Foundation providing special training for general practitioners creating more arthritis clinics, and home-care programs, considerable human suffering is being effectively alleviated. Despite the steady increase of activities, direct assistance is available to only a fraction of the 10,104,000 men and women in this Nation suffering from arthritis and the rheumatic diseases. At the moment, there are only 230 arthritis clinics in the entire United States. If only half of the arthritis sufferers were to seek but 1 visit to a clinic a year, the clinics would be faced with the impossible task of seeing more than 200,000 patients a year in each of the 230 available clinics. This does not include the fact that, in the treatment of arthritis, patients suffering from active forms of the disease must return to the clinic for continuous long-term treatment and the fact that in 14 of the 48 States, there are no arthritis clinics at all.

Coordination of research.—The policy of the Arthritis and Rheumatism Foundation has been to support basic research on a national level. This has been in the form of fellowships. As a matter of record, the foundation's national medical program for the past 3 years has been devoted entirely to the support of young scientists who are working in the field of rheumatic diseases. Each year the money made available for this basic research has been increased.

The Arthritis and Rheumatism Foundation has asked and encouraged its 35 local chapters to include in their programs the support of clinical research, to make possible doctor traineeships, and to also make possible grant-in-aid support of local research projects. The foundation chapters, apart from their support of basic research through their contributions to the national program, have spent $193,305 during the past fiscal year for their own research programs. Most of this money was spent in the field of clinical investigation. The total amount spent for basic and clinical research this past year was $263,305.

The Arthritis and Rheumatism Foundation has not as yet made any effort to coordinate the research that is being done on a local chapter level. The principal reason for this is in the fact that the funds the foundation has been able to make available for research have been limited. As a result, the research projects that are being supported are few. The foundation feels that at this stage in its development there is a great need to encourage all the research it possibly can support without running the risk of discouraging or regimenting research efforts by a system of too close guidance or coordination. Undoubtedly there are cases of duplication in the present research program supported by the foundation and its local chapters. But research in arthritis is relatively new and therefore there is value in, and need for, a certain amount of duplication. When the time comes that the Arthritis and Rheumatism Foundation will be able to increase considerably its research allocations and will be able to support not only more but also more extensive research programs, then it will also find it feasible to institute the more efficient coordination of chapter research.

The National Institute of Arthritis and Metabolic Diseases

Its functions and programs.—When, in June 1950, the House Committee on Interstate and Foreign Commerce reported the omnibus medical research bill to the House, it said:

> In view of the loss of productivity to the Nation, and the burden thrust upon the taxpayer when these diseases strike, and render so many of our people

dependent upon others for support, your committee concluded that such sums as the Congress may deem wise to appropriate for research into the cause and cure of these diseases will undoubtedly represent a saving, rather than a spending of the taxpayer's money.

This committee recognized at that time a fact which escapes many others even yet—that arthritis, and its related rheumatic diseases, constitute a major threat to the health and welfare of our citizens and is the leading cause of chronic illness and disability in this country today. It is a medical, economic, and social threat of the first magnitude.

That bill became Public Law 692 of the 81st Congress. It provided for the establishment within the Public Health Service of the National Institute of Arthritis and Metabolic Diseases and of an advisory council to act as an advisory body. Under the authority provided by this act, the Surgeon General of the Public Health Service, in an order dated November 22, 1950, established the Institute.

In the interests of economy and good administration the then existing Experimental Biology and Medicine Institute was abolished and its activities and funds transferred to the newly created National Institute of Arthritis and Metabolic Diseases. It was recognized by all concerned that very little in the way of funds could be diverted from the important activities covered in the budget of the abolished Institute and that an intramural research program concerned directly with arthritis and the metabolic diseases would have to be built up gradually as funds became available.

In the research grants area a number of projects were being supported in the fields of interest of the National Institute of Arthritis and Metabolic Diseases, and these projects, together with their supporting funds were transferred from the jurisdiction of the Division of Research Grants, National Institutes of Health, to the new Institute.

Thus, although no direct appropriation was made to the Institute for fiscal year 1951, the program, nevertheless, got off to a start in that year.

The table below details the funds which have been available to the support of the Institute's arthritis research programs, for research grants, and for fellowships during the past 3 years, and for the current fiscal year. These sums have been allocated out of total appropriations available to the Institute to carry on not only its arthritis programs, but its responsibilities in the field of metabolic diseases and nutrition, involving such diseases as diabetes, liver disease, bone disease, obesity, and various other metabolic disorders. Total appropriations allocated to intramural research for corresponding years were: 1951, $1,740,000; 1952, $2,365,454; 1953, $2,613,972; 1954, $3,160,000.

NIAMD funds available for arthritis research

	1951	1952	1953	1954
Intramural research	$263,000	$354,000	$443,000	$620,000
Research grants	131,000	600,000	732,000	1,200,000
Total, arthritis research	394,000	954,000	1,175,000	1,820,000

The Institute's broad attack upon the problems of arthritis—its part of the new national program against this most common of chronic

diseases—faces up to many of the most challenging puzzles in medical research. Its programs cover four areas:

1. Pursuit of important leads which promise improvements in the treatment and rehabilitation of patients with arthritis and other rheumatic diseases;

2. Support and stimulation of a nationwide research program in non-Federal institutions;

3. Assistance in bridging the gap between the gaining of new knowledge and its application (by means of training programs which should provide adequate facilities and opportunities for training medical and supporting personnel at all levels);

4. Increasing the numbers of qualified research scientists and clinicians through fellowship programs.

These areas, in turn, fall into two categories, the Institute's intramural research and clinical investigation program, carried on in its own clinical and laboratory research facilities at Bethesda, Md., and its extramural programs, which encompass research grants, fellowship and traineeship awards. The extramural program is guided by the National Advisory Arthritis and Metabolic Diseases Council.

NIAMD intramural research.—The opening, last July, of the new National Institutes of Health Clinical Center, in Bethesda, has made possible the development of a fully rounded program of medical research, in which many delays which too often have intervened between the creation of new knowledge by basic research and its application in the treatment of patients are eliminated. Here, in this new clinical facility the National Institute of Arthritis and Metabolic Diseases is developing a research program which closely integrates the work of the basic research scientists and the clinical investigators. When fully activated the Institute will have 25 beds devoted to the medical care of study patients suffering from arthritis. Here the patient becomes a part of the research team, cooperating with clinicians and research workers. Here, where the patients selected for study may stay as long as necessary, studies may be carried through to completion.

The direction of the Institute's research program, and some idea of its scope may be gained from a description of some of the problems upon which the Institute is now working:

Rheumatoid arthritis.—One of the serious difficulties in this field has been the lack of a specific diagnostic test for rheumatoid arthritis. Work is in progress now in National Institute of Arthritis and Metabolic Diseases laboratories on a serological test which gives promise of being as specific for rheumatoid arthritis as the Wasserman test is for syphilis. Institute scientists are also attempting to purify, isolate, and identify the substance in the patient's serum responsible for positive reactions. A relatively simple, reliable and specific diagnostic test, in the hands of physicians, will constitute a most important step forward in early diagnosis, treatment, and hence, prevention of crippling, which so commonly occurs as the result of rheumatoid arthritis.

Most patients with rheumatoid arthritis have an associated anemia which is resistant to the usual therapeutic measures. Studies are being conducted to determine the nature, cause, and the mechanism of this anemia. Radioactive isotopes are being used to tag the red blood cells of arthritis patients in order to determine whether the cells are destroyed more rapidly than normal, whether the life span of the

arthritic patient's red cell is shortened or whether there is inadequate production of red cells. Once the mechanism of this anemia is understood, it is likely that we will be able to combat the anemia and hence increase the resistance and stamina of the arthritic patient.

Cortisone has been found to be a most useful hormone in the treatment of certain cases of rheumatoid arthritis. However, certain side effects develop which constitute a serious limitation on the value of this drug. It is extremely important to select the proper patients with rheumatoid arthritis for this treatment. The criteria for the proper selection of patients are being carefully defined.

The discovery that cortisone is useful in rheumatoid arthritis stems from the observation that women with this disease have a dramatic remission when pregnant. It has been observed that the cortisone concentration in the blood and tissues of pregnant women rises several-fold. It is remarkable that none of the pregnant women develop any of the side effects from cortisone seen in patients to whom cortisone is administered. Evidently nature's secret of how to skillfully administer cortisone so that the benefits will not be mitigated by undesirable side effects has eluded the physician. An attempt will be made to find means of preventing the destruction of cortisone by certain enzyme systems in the body of an arthritic patient. If this should prove possible, much smaller doses of cortisone could then be administered with satisfactory therapeutic effects and without the bad side effects. This objective will be pursued by means of studying the distribution, utilization, destruction, and excretion of radioactive cortisone which has just become available through the efforts of the National Institute of Arthritis and Metabolic Diseases.

Gout.—Although gout is not as common as rheumatoid arthritis, it is nevertheless a serious crippling disease and is familial in nature. It evidently results from an inborn error in metabolism which is manifest by an excessive amount of uric acid in the tissues and blood so that a patient with gout may have 10 to 20 times the amount of uric acid in his body as a normal person. Although this disease has been recognized for nearly 25 centuries, we still do not know whether the excessive amounts of uric acid result from an increased production, an inadequate utilization, or insufficient excretion. Evidence has recently been collected to indicate that some gouty patients synthesize uric acid more rapidly than the normal person by shortcutting the usual pathway. Work is being done in National Institute of Arthritis and Metabolic Diseases laboratories to determine exactly where this metabolic shunt occurs. Satisfactory progress has been made in the initial steps of this study and seems promising.

Scleroderma.—There is a group of diseases known as "collagen diseases," which has a common denominator, an abnormal alteration of the connective tissue of the body. Most of these diseases are fatal and the cause of all of them is unknown. Scleroderma is an illustrative type of this group of diseases. A quantitative chemical method has been developed and perfected in National Institute of Arthritis and Metabolic Diseases laboratories for analyzing an important component of the ground substance or matrix which fills the interstices between the connective tissue fibers. This method will now be utilized in order to determine whether the abnormality of the connective tissue in scleroderma consists of an inadequate or excessive amount of one constituent of ground substance. The various physiological factors

governing the production of this ground substance component are also being defined. It is now known, for example, that the thyroid hormone plays an important role in this function.

During the past year staff scientists, together with the recipients of research grants from this Institute, have contributed significantly to medical knowledge. Among the accomplishments worthy of mention are the following:

Evaluation of cortisone treatment.—Significant results have been obtained from the continuation of a followup study to appraise the value of prolonged cortisone administration to patients with rheumatoid arthritis. Initiated in 1949, this study is supported by a National Institute of Arthritis and Metabolic Diseases grant to New York University College of Medicine.

Of the 78 arthritis patients originally included in this study, 7 discontinued the hormone inside of 6 weeks and were eliminated from the series. Of the remaining 71 patients, 15 had a clinical remission and are totally free of the troublesome and painful symptoms of arthritis; 4 have been off cortisone for longer than 2 years. On the other hand, 9 patients of the 71 have not had enough benefit from cortisone to warrent its continued use.

A total of 58 patients were followed long enough to permit evaluation. Before treatment, 31 were not self-sufficient and could not take care of their daily needs; 25 of these became self-sufficient as a result of cortisone therapy. Before treatment, 17 patients were bed-ridden and 11 were in wheelchairs or walked with the aid of crutches or canes; the former group was reduced to 2 and the latter to 4 as a result of the treatment.

Epidemiology and incidence of arthritis in industry.—Accurate and reliable data on the incidence of the clearly defined types of arthritis in industry in the United States have not been available. To initiate a survey in this important area a project supported by a grant from the Arthritis and Rheumatism Foundation and directed by a member of the National Institute of Arthritis and Metabolic Diseases clinical investigations staff has been analyzing the medical records of the Consolidated Edison Co. of New York. Although results have not been completely analyzed and reported, it has been found that during the 5-year period, 1947–51 inclusive, 5,300 employees among the 25,000 employed by the company have been absent from work because of disability resulting from the various types of arthritis and nonarticular rheumatism.

Search for cortisone precursors.—In collaboration with the United States Department of Agriculture, the National Institute of Arthritis and Metabolic Diseases has collected both from the United States and abroad a number of plants which appeared to be promising vegetable sources of naturally occurring compounds which might successfully be synthesized. The steroid content of these plants has been determined and studies made of the transformation of these compounds to cortisone. The sex hormones are usually intermediates in this process. As a result of studies similar to these the price of cortisone has dropped in the past few years from about $200 per gram to $7. The best plant source at the present time is the Mexican yam, but the supply of this yam is not unlimited and it has not yet been brought under successful cultivation. Other possible sources are tomatidine, from the tomato plant (shown by the chemists to be rather easily transformed chem-

ically, as far as the sex-hormone stage), stigmasterol from the soybean, and becogenin from the yucca and agave plants. The possibility of obtaining useful steroids from the hemp industry and from fermentation is under investigation.

The adrenal-pituitary relationship and the role of the central nervous system in this function.—Progress has been made in our understanding of the bodily controls of the pituitary and adrenal glands particularly the relationship of the central nervous system. Since ACTH, from the pituitary, and cortisone and compound F, from the adrenal, are so very useful in the treatment of rheumatoid arthritis, the value of these studies to our understanding of the rheumatic diseases is obvious. The possible relationship between arthritis and abnormalities in glandular function still remains obscure.

Measurement of the cortical hormones and their metabolites.—New and ingenious tools have been devised for the measurement of cortical hormones and their metabolites. In the Institute's laboratories a new biological method has been perfected for the estimation of minute amounts of cortical hormones in body fluids. Filter-paper chromatography has proved successful as a means of separating the important steroids, one from another. Studies are under way on the application of these and other new methods to the patient suffering from arthritis.

Extramural programs.—Through its extramural programs the National Institute of Arthritis and Metabolic Diseases supports research in non-Federal institutions, provides grants for fellowships to develop research talent, and clinical traineeships for the study of the prevention, diagnosis, and treatment of arthritis and the metabolic diseases.

During the fiscal year 1953 a total of 250 grants-in-aid, to 106 medical-research institutions in 37 States, the District of Columbia, and 2 foreign countries, totaling $2,721,634 were recommended by the National Advisory Arthritis and Metabolic Diseases Council and approved by the Surgeon General. Research fellowships totaling $150,000 were granted to 44 outstanding candidates at 20 institutions in 12 different States. Training stipends amounting to $51,000 were awarded to 15 physicians to assist them in improving their competence by enabling them to learn the latest techniques in the diagnosis, treatment, and rehabilitation of patients.

Only a portion of the total funds appropriated by Congress to the Institute for extramural programs can be devoted to arthritis, per se, for the National Institute of Arthritis and Metabolic Diseases has responsibilities for the maintenance of research and training in the metabolic diseases as well. But it should be borne in mind that the answers to the problems of arthritis might well come from research in apparently unrelated disciplines such as metabolism, enzyme chemistry, biophysics, endocrinology, histochemistry, and the like, rather than from research which now can be labeled as "Arthritis research."

To research projects which could be tagged definitely as arthritis research, grants totaling $732,000 were awarded in fiscal year 1953. In fiscal 1954 the amount to be granted for this purpose is estimated at $1,200,000, a substantial increase.

For research fellowships in arthritis and other rheumatic diseases a total of $15,000 was awarded in 1953, with an estimated $40,000 to be similarly granted in 1954.

Clinical traineeships awards totaling $27,500 were awarded in fiscal 1953, while in fiscal 1954 a greatly enlarged program will provide an estimated $100,000 for this purpose.

Among the accomplishments recorded by recipients of arthritis-research grants was one that made headline news—the successful production, for the first time, of radioactive cortisone, hydrocortisone, and corticosterone in sufficient quantity for research studies. The radioactive hormones have been made available to qualified scientists in this country through the National Institute of Arthritis and Metabolic Diseases. They will be used to conduct tracer studies in attempts to determine how these hormones operate in arthritis and other diseases.

Development of new methods for the measurement of minute amounts of adrenal cortical hormones in blood, tissues, and excreta will make possible many studies which could not be undertaken heretofore—studies which will enable us to determine the exact disposition and metabolic fate of these hormones.

E. PROGRESS AGAINST ARTHRITIS AND RHEUMATISM

Although the organized attack on arthritis and rheumatism is quite new and relatively small, encouraging progress already has been made, the momentum is picking up, and with continued and augmented support, there is every reason to believe that a fully effective mobilization of effort can be built up and continued substantial achievements made. The still existing gaps in our knowledge, our trained manpower, and our facilities must be overcome, and can be.

The climate is favorable for continued progress at an accelerated rate. The outlook, since 1948, has changed dramatically. Today there is hope and eagerness, a buildup of enthusiasm, improved facilities, new techniques, new leads, where, in 1948, only 5 short years ago, these definitely were not present. But the needs still are great, the problems challenging.

Throughout the United States in 1946, only $45,000 was spent on rheumatic-disease research. In 1948 the amount had increased to $300,000, and in 1952 a total of $1,100,000 was backing up research in this field. However encouraging this increase in support might appear, the 1952 total amounted to little more than 10 cents for each of the 10 million arthritis victims in the country, and compares weakly with the approximately $19 million spent annually on research into another of the major chronic diseases.

Although the resources so far employed against arthritis and rheumatism might appear to be somewhat minimal when compared with other campaigns against even less widespread chronic affiictions, and although the organized attack against arthritis and rheumatism is of quite recent vintage, there has been great and encouraging progress, greater progress than had been made in hundreds of preceding years.

Era of growth and accomplishment

The present situation, then, is one of growth and development, of an expansion of interest. There is a growing feeling of confidence that the answers to many of the problems which still con-

front us will be found in the immediate future. Scientists backed by funds provided by both private and public sources, are now probing into new and promising fields. New techniques, new leads, new tools are broadening the scope of research.

Meanwhile, clinicians, armed with new drugs and methods, can now relieve much of the suffering, forestall some attacks, clear up certain infections which lead to arthritis complications.

New and ingenious methods of rehabilitation have been devised, and today many, formerly doomed to exist as helpless arthritic cripples, can be restored to useful lives.

The organization, leadership and funds provided by the Government and public agencies in the arthritis field have sparked new activity throughout the country. Many new and expert energies have been brought to bear on the problems; much new knowledge and a better understanding of the complexities of the rheumatic-disease family has been accumulating. New keys and pathways for research have been discovered.

Cortisone, ACTH, hydrocortizone, butazolidin, and other new drugs have had a mighty impact upon the situation. Although none of these can be regarded as a "cure," it is certain that not only have they brought relief to and contributed to the rehabilitation of thousands of sufferers, but they have provided a key to the effective control of the worst forms of arthritis, have changed many concepts, and broadened the field of research by indicating that hormonal balance and metabolism may be most important factors in the causation and evolution of the disease.

From the most neglected disease area in medicine, the rheumatic diseases are emerging as a challenging and promising field of effort. Interest is rising and must be further encouraged and cultivated. There are more arthritis clinics, and more doctors who are competent to treat the disease more effectively, though the number of clinics and doctors is inadequate to meet this country's present needs. More first-rate scientists, challenged by the problems and encouraged by the availability of financial support are searching for the answers and coming up with leads and interesting developments.

Medical schools are beginning to devote more time and effort to teaching students about the rheumatic diseases. Many medical schools are distributing to students as an aid in education in this field the Manual for Arthritis Clinics, written by a committee of the New York Rheumatism Association and published jointly by the Arthritis and Rheumatism Foundation and the National Institute of Arthritis and Metabolic Diseases; the Bulletin on Rheumatic Diseases, published by the Arthritis and Rheumatism Foundation; and the Primer on Rheumatic Diseases, and Rheumatism Reviews, published by the American Rheumatism Association.

The informational and educational activities of each of three organizations in the field, the Arthritis and Rheumatism Foundation, the American Rheumatism Association and the National Institute of Arthritis and Metabolic Diseases, are providing the public and the medical profession with materials calculated to bring about a better knowledge and understanding of the problems surrounding the area, of new developments, and of medical services available.

What are some of the new developments, discoveries, and techniques which have brought about this resurgence of interest, this new parade

of progress in medicine's formerly most neglected major disease entity?

Here is a list, compiled by the National Institute of Arthritis and Metabolic Diseases, of some of the most important advances during the past 5 years:

40 SIGNIFICANT ADVANCES

General

1. Description of exact blood and nerve supply of joints.
2. Analysis of cellular and chemical constituents and of the physical nature of fluid in joints of different types of arthritis.
3. Development of a satisfactory technique for obtaining samples of tissue from the lining of joints, suitable for microscopic examination (synovial tissue biopsy).
4. Appearance of the monthly scientific publication Bulletin on Rheumatic Diseases published and distributed without charge by the Arthritis and Rheumatism Foundation. Circulation over 20,000. Reaches medical students and physicians in America, Europe, Australia, Asia, and Africa.
5. Appearance of Manual on Arthritis Clinics which establishes exact diagnostic criteria for every type of arthritis and rheumatism. Adopted by the American Rheumatism Association and published by the Arthritis and Rheumatism Foundation in cooperation with the National Institute of Arthritis and Metabolic Diseases.
6. Two revisions of Primer on Rheumatic Diseases by the American Rheumatism Association, bringing the medical student and physician up to date on newer concepts of these diseases.

Cortisone, hydrocortisone, and ACTH

1. Synthesis of cortisone achieved.
2. Synthesis of radioactive cortisone and hydrocortisone which makes possible detection and measurement of minute amounts of hormone in blood, urine and tissues.
3. Discovery of striking clinical effects in rheumatoid arthritis, rheumatic fever, gout and lupus erythematosus.
4. Discovery of important influence on growth of connective tissue.
5. Knowledge of metabolic and physiological changes induced by these hormones.

Rheumatoid arthritis

1. Discovery of new diagnostic blood test for rheumatoid arthritis.
2. Discovery of special type of heart and blood vessel disease in rheumatoid arthritis.
3. Development of ingenious methods for rehabilitation of disabled rheumatoid cripples.
4. Evaluation of new antiarthritic drug, phenylbutazone, effective in treatment of rheumatoid arthritis, especially when the spine is involved.
5. New and more satisfactory procedures for surgical reconstruction of deformed joints.
6. Reevaluation of gold compound in treatment of rheumatoid arthritis.
7. The natural clinical course of rheumatoid arthritis—charted for the first time.
8. Knowledge of hereditary factors concerned in rheumatoid arthritis and spondylitis.
9. Analysis and clarification of psychological factors concerned in precipitating or aggravating episodes of rheumatoid arthritis.
10. Experimental production of subcutaneous nodules, a characteristic feature of rheumatoid arthritis and rheumatic fever.
11. Adoption by the American Rheumatism Association of uniform nomenclature, classification and grading of therapeutic results obtained in rheumatoid arthritis.

Gout

1. Discovery of a relatively nontoxic drug, benemid, which effectively reduces the excessive uric acid content of all tissues in a gouty patient. For the first time in the history of medicine a method is available for causing the disappearance of harmful uric acid deposits (tophi) from vital structures.

2. Discovery of a drug, phenylbutazone, which reduces the uric acid content of the blood and quickly terminates acute attacks of gouty arthritis.
3. Development of precise methods for measuring the body's uric acid content and tracing the synthesis and breakdown of uric acid in normal persons and patients with gout.
4. Knowledge as to the nature of the inborn error of purine metabolism in gout.
5. New concepts of the nature of the hereditary factors concerned in the incidence of gout.

Osteoarthritis

1. New and more satisfactory surgical procedures for reconstruction of hip joints destroyed by osteoarthritis.
2. New knowledge concerning metabolic changes in cartilage of joints which precedes and promotes aging process characteristic of osteoarthritis.
3. Analysis of role of hereditary factors in development of osteoarthritis.
4. Discovery of role of certain hormones and dietary factors in osteoarthritis in experimental animals.

Arthritis caused by microbial infections

1. Effective antibiotic therapy has controlled bacterial infections to such an extent that microbial invasion of joints from remote foci of infection has become rare.

Connective tissue

1. Description of ultramicroscopic structure of connective tissue fibers as seen by electron microscope.
2. Description of complex chemical nature of ground substance in which connective tissue fibers are embedded.
3. Development of special dyes which selectively stain certain components of normal and pathological connective tissue fibers and ground substance and thereby identify the chemical nature of these structures (histochemistry).
4. Discovery of biochemical requirements for synthesis of connective tissue fibers.

Collagen diseases

1. Discovery of diagnostic test for lupus erythematosus, a fatal disease of heart, kidneys, blood vessels, connective tissue and joints which heretofore was frequently unrecognized and undiagnosed.
2. Production of changes in blood vessels and connective tissue of experimental animals which closely resemble lesions observed in collagen diseases.
3. Description of chemical nature of changes in blood vessels, connective tissue fibers, and ground substance encountered in collagen diseases.
4. Revision and clarification of clinical concepts of the diseases included in this group and their interrelationship.

F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

Although medicine and public health may be moderately proud of the progress made since the organized attack on arthritis got underway a few short years ago, the overall problem itself is so immense, so diffuse, and has so many facets that it is obvious there can be no quick, easy, or single solution. The demands of the situation call for continued and augmented effort, for unceasing diligence, thorough and competent research, improved medical instruction reaching more and more students and physicians, more laboratory space, and increased amount of effective public education—the list of needs is long. To be more specific:

Expanded research effort

The need for new knowledge in the medical sciences is most pressing. We need to know more about the structure, composition, and functions of human and animal tissues, especially connective tissue. This calls for scientists skilled in biology, biophysics, biochemistry (especially enzyme chemistry), endocrinology, and clinical medicine.

It should be emphasized that it is essential that scientists drawn from these disciplines must work closely with the clinical investigators who have first-hand familiarity with the gaps in our knowledge. The direction, the goals, the needs must be defined by the physician who faces the responsibility of controlling these recalcitrant diseases. On the other hand, the exploration of the unknown, the discovery of enzyme systems involved in the mechanism of certain diseases, the development of new and precise analytical, chemical, and physical methods, the exact nature of hormonal imbalance must be worked out in the laboratory. But always there must be the closest possible integration of efforts and interchange of ideas between the clinician and the laboratory worker.

One of the stumbling blocks which must be overcome relates to laboratory animals. Much basic medical research depends heavily upon experiments with small animals. In the field of arthritis, animal research has been hampered by the fact that rheumatoid arthritis does not occur naturally in laboratory animals, and an effective method for inducing this type of arthritis in them has not yet been found, although some encouraging results of a preliminary nature have been reported. Much work remains to be done in this important basic area.

More clinical studies

Clinical studies of victims of arthritis needs greatly to be expanded. There are many unanswered questions. Why are some persons susceptible, some not? What are the effects of diet, environment, personality, hormone functions, heredity? What causes the various types of arthritis? What actually happens in the body when rheumatoid arthritis strikes—what conditions might be the precursors of an attack? If we can find the answers, then perhaps we can find ways to reverse or stop the course of events which lead to an attack.

The tissues involved in the rheumatic diseases—

said Dr. Charles Ragan in his statement to the committee—

have been studied extensively but we still know relatively little about their characteristics. This is arduous work, requiring a great deal of basic fundamental training, experience, and equipment, but, in the last 5 years our knowledge of the collagens and the complex sugars of the connective tissues has progressed rapidly. The mingling of these chemical and physical studies with those of hypersensitivity presents a great challenge. There is a theory that the reaction ending in the disease state is initiated by a component of this tissue and is perpetuated through the mechanisms of sensitivity.

Cause not known

* * * These (rheumatic) diseases are peculiar in that they show inflammation without known cause, such as bacteria, a virus, or a known antigen-antibody reaction. Many of the agents which are used for the control of these diseases—aspirin, cortisone and phenylbutazone—have properties which permit them to be called anti-inflammatory; in other words, they counteract inflammation. Two possible advances might emanate from such studies. The first, better agents to control inflammation might be discovered. The second, and to me more important in the long run, a more detailed knowledge of the inflammatory reaction might be obtained whereby we might deal with this reaction in the disease state with more knowledgeable assurance and hence with less chance of error.

On the clinical plane more studies are needed to determine, if possible, the factors which may be blamed as precipitating ones. If these can be pinpointed and eliminated, much could be done to control the disease.

Continued application and further refinement of the present methods of management of these diseases should bear fruit since no one can, at present, with assurance, outline an ideal method of utilizing existing therapeutic agents. The lack of unanimity concerning their application bespeaks both their inadequacy and our lack of complete knowledge concerning their exploitation.

In summary, then, there are pathways through which our present knowledge may be extended and amplified with the hope that ultimately this group of diseases may be controlled, and, once their causation is more clearly understood, cured, or prevented from developing. The problems are there, but the great deficiency at present is men trained in the needed disciplines, who must be enlisted from the predoctoral and postdoctoral students in the basic sciences and in medicine.

Epidemiological studies needed

Another area for inquiry involves the sociological question—the effect of arthritis on society as a whole. What is the role of environment in arthritis? When millions of our citizens are suffering from this disease it is bound to have an effect upon us all—economically and sociologically. Just what are these effects?

We also need to know, more specifically than we do, more about the extent of the rheumatic diseases among our people. Epidemiological studies are indicated. What we know about the prevalence of the rheumatic diseases is based upon rather limited and comparatively crude data. This must be remedied.

Medical education and training

Because for years there was little that medicine could actually do even to relieve, let alone cure, those who suffered from rheumatic diseases, both the medical profession and the public came to regard them as something you sort of "had to learn to live with." This apathy still persists, although to a more limited degree. It is difficult, in many quarters yet, to arouse interest in the problem. Medical schools still do not provide adequate instruction in the rheumatic diseases to either undergraduate or postgraduate students. Curricula are already crowded with other subjects. The schools lack adequate instructors and adequate space for research laboratories, clinical investigations, and training. They must be stimulated and helped. Better and more teaching and specialized training must be provided. This can be done by making grants to medical schools.

Construction needs

Funds for construction of laboratory, training, and clinical facilities must be made available to the medical schools which are in desperate need financially.

Pointing up the pressing needs in the areas of medical education, training, and laboratory facilities, Dean Currier McEwen, in his statement to the committee, said:

> The advances that have been made both in patient care and in research in the past few years are great, but we must accept the sobering realization that this progress has been too much dependent on far too small a number of individuals. The whole membership of the American Rheumatism Association, which includes most physicians in the United States who have a special interest in the rheumatic diseases, totals less than 800 or approximately 1 to each 165,000 of the population. Moreover, the facilities and the skills necessary for first-class clinical and laboratory investigators in arthritis and rheumatism are woefully inadequate. This is a deficiency which can be easily overlooked because of the quality of much of the work which has been done; but even the most cur-

sory comparison with the research opportunities in other branches of internal medicine shows how true it is.

The crux of the matter is that although the quality of work in the rheumatic diseases has improved enormously in the past 25 years, the number of trained workers has increased very slowly.

* * * Primarily, I believe, the cause can be traced to our medical schools; for in not more than half a dozen of them are there now full-time faculty members and facilities devoted to the study of rheumatic diseases comparable to those which would be taken for granted in practically every medical school in the country for work in such other important diseases as cancer, diseases of the heart, nephritis, and the like. These are, of course, in many schools very capable men caring for patients, teaching and carrying out clinical studies on a part-time basis; but in modern medical education it is the full-time faculty member who influences the student the most, just as it is the full-time men who attract research grants. Thus, the eager young potential investigator in student bodies throughout the country make scientific attachments as undergraduates or as interns which lead them to careers in cardiology, hypertension, diabetes, and other branches of internal medicine in their later years but rarely to clinical or research careers in arthritis and rheumatism.

One may well ask why it is that the rheumatic diseases have so few full-time disciples among the faculties. The answer, I believe, is easily found if one considers the development of modern American medical education. As the period of the proprietary schools came to an end and funds began to be available for medical schools through their parent universities, the first departments to be developed were those of the basic sciences. Only much later did similar support become available for the clinical departments, and the meager funds at hand were, quite naturally, used to exploit those fields of internal medicine which were currently important, such as infectious diseases which the work of the French and German bacteriologists had placed on a scientific basis, and cardiology which was flowering under the stimulus of the English and Dutch clinicians and physiologists. Little by little, as the budgets of medical schools expanded, a nucleus of full-time men took their places in departments of medicine, and, of course, the fields from which they were recruited were those of current scientific advance and interest. Unfortunately, the rheumatic diseases have been late in reaching scientific maturity. The reasons are many, but the practical point of the matter is that now that one might expect to see the gradual development of the rheumatic diseases as a major component of the country's departments of medicine, the budgets of the schools are so strained that the addition of personnel and facilities through university support is a very remote possibility. In the course of time, as vacancies develop in teaching staffs, one can now expect that a reasonable share of the places will be filled by men with special interest in the rheumatic diseases. This process, however, will require many years before it begins to pay dividends in the form of a rapid increase in the number of investigators and clinicians.

I submit that the only possible answer lies in the provision of new funds to support the work of the medical schools in the rheumatic diseases. Ideally this would be in the form of gifts to endow salaries and to construct the vitally needed laboratories. Unfortunately, however, gifts and bequests of the size required are unlikely to solve the problem in very many institutions. In this situation it is earnestly to be hoped that Congress will appropriate the funds needed to enable the United States Public Health Service to make teaching grants and construction grants in the field of arthritis and rheumatism. Such grants have been of incalculable benefit in cancer, diseases of the heart, and mental diseases, in which at least moderately adequate facilities already existed. They would be of even greater benefit in the case of rheumatic diseases because of the almost complete lack of existing teaching funds and laboratory facilities in that field. The grants-in-aid of research and the traineeships and fellowships which the National Institute of Arthritis and Metabolic Diseases, the Arthritis and Rheumatism Foundation, the Masonic Foundation for Medical Research and Human Welfare, and other agencies have provided in recent years have been of the greatest aid. In addition to these forms of support, however, there is urgent need for teaching and construction grants to the medical schools if we are to overcome the present bottleneck of insufficient numbers of young physicians entering the ranks each year to carry on the fight against these diseases which are the greatest cause of disability in our Nation today.

In answer to a question as to which activity was most important—research grants, traineeships, fellowships, teaching grants, or construction grants—Dr. McEwen said:

> I think it is in some sense like deciding which one of the wheels of an automobile you are going to leave off. It is awfully difficult to say whether the front left wheel is more important than the right front wheel, and so on. You need to have a balanced and smoothly operating machine. Certainly, the needs of research are tremendous * * *. I, nevertheless, emphasize—I hope properly—the fact that even today, and although there is no doubt about the fact that there is a shortage of trained people to work in this field—even today, the National Institute of Arthritis and Metabolic Diseases receives applications for more worthwhile projects than their present research funds can take care of * * *.
>
> I am deeply concerned by the immediate bottlenecks which do exist, especially in the teaching area, with the shortcomings there, but I have great admiration for the way in which the problem is being tackled by the National Institute of Arthritis and Metabolic Diseases, and I have great optimism about what can be done in making these diseases, so far, incurable for the most part, curable in the future, and no longer such a threat to our country.

Guidelines for the future

The national attack on arthritis and its related rheumatic diseases, fully organized for only 3 years, has brought about tremendous advances in our knowledge of, interest in, and ability to do something about this group of vicious, disabling chronic afflictions. Only now, after centuries of neglect, is real progress being made. Although these diseases annually afflict millions of our citizens, it is only recently that they have been accepted as a medico-socio-economic problem of the first magnitude.

We are now at the point where the future holds promise of great gains; at the interim point where the momentum gained within the past few years may be applied with greatest effect to bring out early answers to the problems which still block the discoveries which will solve the ultimate riddle.

The goals are not within easy reach, but they are far closer than they were just 5 years ago. There is every reason to believe that, profiting from, and building upon the progress made to date, the day will soon some when arthritis and its cousins will no longer constitute the most common major chronic affliction of mankind.

No feeling of complacency is justified, no rash claims can be made, no easy predictions put forward, however, for the sum total of our knowledge, our facilities, and our trained manpower, while considerable and effective, still has grievous gaps.

The advice and recommendations provided to the committee by its panel of experts in the rheumatic diseases indicates that, to consolidate the gains won in the past few years, to capitalize upon the resurgence of public and professional interest in the problem of arthritis and rheumatic disease, and to follow through effectively upon the leads which have been developed by research, these are basic requirements:

1. Sustained and augmented support of fundamental and clinical research.
2. Sustained and augmented support for research fellowship and traineeship programs.
3. Establishment of a program providing for teaching grants, to provide funds to medical schools for the support of teaching programs in the rheumatic diseases.

4. Establishment of a program of construction grants to provide laboratory facilities for the training of students.

Witnesses pointed out that the program of the National Institute of Arthritis and Metabolic Diseases, most effective as far as it goes, does not provide for either teaching or construction grants, which have been demonstrated to be of great value in the heart disease and cancer programs. In the rheumatic-disease field, it was pointed out, such grants would be even more valuable, for trained manpower in this area is the real up-coming bottleneck, a substantial obstacle to further progress.

Shortage of clinicians

It was also pointed out that despite the several gaps in our knowledge concerning these diseases, more is now known than is being applied in practice. Major reason is the shortage of well-trained clinicians. There are less than 800 members of the American Rheumatism Association, the only professional organization with special interests in that area.

Not only is there a dearth of physicians trained in the field, but the supply of qualified research personnel is inadequate relative to the importance of these diseases.

The consensus, then, is that there now exists the machinery and the leadership for a really effective attack on medicine's most neglected major-disease entity and that a good start has been made in the battle against it, but that there is need for continued and augmented effort to push beyond the presently existing frontiers of knowledge.

CHAPTER IX

DIABETES

A. SUMMARY

Testimony presented before the committee developed the following information concerning diabetes mellitus:

It is estimated that at least 2 million people in the United States have diabetes—or 13 of every 1,000. Of these 2 million, about 1 million do not know they have the disease.

Diabetes is found most frequently in persons over 40 years of age, in those who are overweight, or in those who have a history of diabetes in the family. It may, however, occur at any age—about one-fifth of all diabetics are under 45 years of age, nearly one-half are between 45 and 64, and about one-third are 65 and over. About 3 out of 8 known cases are male, 5 out of 8 female.

Among chronic diseases that cause death in adults, only cardiovascular diseases and cancer exceed diabetes.

The discovery of insulin in 1921 gave us an effective method of controlling severe diabetes, and since that time much progress has been made in combating the disease.

The most effective method of preventing complications and premature deaths from diabetes is early detection. In recent years, increased awareness of diabetes and increased case finding have been major projects of the American Diabetes Association (a voluntary organization) and the United States Public Health Service.

The American Diabetes Association conducts an extensive year-round program to find as many as possible of the million unknown diabetics. This program is highlighted each fall by Diabetes Week, when communities throughout the United States are encouraged to participate in case-finding programs. The association also carries on continuing programs of professional and public education. One of its major functions is the support of summer camps for diabetic children.

The United States Public Health Service is concerned with research designed to answer some of the questions about diabetes, the development of techniques and materials for professional and patient education, and professional consultation to State and local health departments.

With nationwide attention increasingly focused on the disease, it is hoped that complete control of diabetes and prevention of its crippling complications may, eventually, be fully realized.

B. WHAT IS DIABETES?

Diabetes mellitus, or sugar diabetes, as it is commonly called, is one of the oldest diseases known to man. It is a chronic disease, in which the body's function of turning starch and sugar into energy is dis-

turbed. In diabetes, sugar from the food we eat accumulates excessively in the blood. It is not burned to produce the heat and energy necessary for normal function. The body is able to burn sugar or store it for future use because of the presence of a secretion called insulin. This is liberated into the blood stream by special cells in the pancreas, a gland located just behind the stomach. Diabetes is caused when the body does not manufacture enough insulin or cannot make proper use of the insulin produced.

C. THE HUMAN AND ECONOMIC BURDEN

Diabetes is most frequently found in persons over 40 years of age, in those who are overweight, or in those who have a history of diabetes in the family. How many people have diabetes is not exactly known because there is no systematic scheme for collecting data of this kind on a national scale. However, it is estimated that there are at least 2 million people in the United States with diabetes, or 13 out of every 1,000. Of the 2 million persons with diabetes, about 1 million do not know they have it. Because the disease is often without symptoms at onset, it may remain hidden for many years before being detected through a routine test for sugar.

Although diabetes is most frequently found in midde-aged and older people, it may occur at any age. It affects both men and women, and is found in all parts of the world. About one-fifth of all diabetics are under 45 years of age, nearly half are between 45 and 64, and the rest—about one-third—are 65 and over. Males account for about 3 out of 8 known cases, and females for about 5 out of 8.

The prevalence of the disease, as judged by death rates, appears to be higher in this country than anywhere else in the world. Among chronic diseases that cause death in adults, only cardiovascular diseases and cancer exceed diabetes. In 1952, approximately 25,000 persons died as a direct result of diabetes, and this represents only about half of all deaths among diabetics each year. The difference lies in the fact that many diabetics do not die of the disease itself, but rather of complications, chiefly diseases of the heart and circulatory system.

Usually diabetes becomes serious when the diabetic does not know of his condition, or when he allows the known condition to get out of control. If this happens, it can lead to a number of complications, including hardening of the arteries, heart disease, kidney disease, neuritis, gangrene of the legs and feet, and blindness. These complications are the major causes of invalidism and death among diabetic patients.

Because one or more of these complications so often develop as a result of diabetes, the economic cost of the disease to the Nation is very considerable. From various studies conducted in the United States, it is estimated that 368,000 life-years were lost in 1952 because of premature deaths from diabetes. Of these, over 100,000 were in the most productive period of life—the ages 15 to 65. Prevention of premature deaths between these ages alone would mean an increase in the gross national income of more than $150 million (assuming that half the man-years saved would be income producing).

In the National Health Survey conducted in 1935–36, diabetes ranked 11th among the chronic diseases in the number of days lost

from work or other usual activity. It was further estimated that nearly 35,000 persons were invalids because of the disease. And these figures are considered much lower than those prevailing at the present time.

Because diabetes is most prevalent in people over 40 years of age, and since this part of our population is growing in size from year to year, we can continue to expect an increase in the cost of diabetes to the national economy. One bit of evidence on the cost of diabetes to the country in public-medical care and public-welfare service is found in figures from the Veterans' Administration for 1952. In that year, over $800,000 a month was paid to veterans because of diabetes.

Since the discovery of insulin in 1921, much progress has been made in treating diabetics and in maintaining their satisfactory health. Perhaps one of the greatest medical finds of all time has been the discovery of insulin. Surely, for the diabetic, it is the most noteworthy. Before the use of insulin, truly effective methods for controlling severe diabetes were lacking, and death from the disease was high. Diabetic children and young adults in most instances lived less than a year after the condition developed. The discovery of insulin has drastically reduced deaths in the younger age groups.

Today, almost all cases of uncomplicated diabetes can be well controlled by proper use of diet and insulin. Diet is an essential part of treatment in all cases; insulin, in addition to diet, is necessary in 50 to 60 percent.

The average cost of medical care for the diabetic patient cannot be fully tabulated. It has, however, been estimated that a person with well-controlled diabetes, who requires only a small dosage of insulin each day, will need a minimum of $13.50 a month for insulin, diet, equipment, and medical care. For the country as a whole, then, this would mean that a total of $150 million above usual living expenses is required each year by our known diabetic population. And this does not include costs for hospitalization or expenses resulting from the other complications that may arise with diabetes.

We have tried to estimate the cost of diabetes in dollars and cents to the patient and to the country as a whole. But what of the daily family and personal cost which can never be measured?

The diabetic patient faces frequent hospitalization for crises and complications. He is often unable to find employment because of his disease. It is more difficult for him to obtain life and health insurance.

The diabetic patient is restricted to special diets that cannot be based on low-cost carbohydrate foods.

Since insulin must be taken daily in more than half the cases of diabetes, the patient or some member of his family must learn to administer it.

The diabetic is susceptible to visual impairment often leading to blindness. He must follow rigid precautions to avoid insulin shock.

And the diabetic is faced with anxieties associated with childbearing. Sterility, miscarriage, early fetal death, and stillbirth are more common among diabetic women than among normal ones.

An understanding of diabetes and full cooperation between the patient and his physician are probably more important in the successful treatment of diabetes than in almost any other disease. Although the condition of undetected and untreated diabetes can become ex-

tremely serious, the patient who knows how to care for himself and is willing to follow his doctor's instructions to the letter stands a good chance of living a reasonably long and active life.

D. THE NATIONAL ATTACK ON DIABETES

Before the patient can be put under medical care, his condition must, of course, be diagnosed. In recent years increased awareness of diabetes and increased activity in case finding have been major projects of the American Diabetes Association and the United States Public Health Service.

The American Diabetes Association

An extensive year-round program is being conducted by the American Diabetes Association to find as many as possible of the undiscovered diabetics—estimated to be at least 1 million—and to bring them under medical care. The program is highlighted each fall by Diabetes Week, when extensive publicity campaigns are conducted in communities throughout the United States to encourage their populations to take part in the testing. In each locality the diabetes detection drive is carried on with the help of many civic organizations and labor, business, and school groups.

The American Diabetes Association is a nonprofit organization composed of some 1,800 professional members. It was organized by a group of physicians interested in the problems of diabetes, and it aims toward improving the general welfare of the diabetic. In addition to its case-finding activities, the association carries on many projects concerned with diabetes. Among these is an interchange of knowledge and information about the disease among physicians. In this phase of its program the American Diabetes Association seeks to widen the knowledge of diabetes among physicians and to keep them abreast of developments in treatment and research. Naturally, the diabetic patient benefits greatly from this type of informational exchange.

Another part of the association's program is patient education. Much of the diabetic's success in controlling his diabetes depends largely on his understanding and his adherence to a medical routine prescribed by his physician. Forecast is a magazine published and distributed by the association, and often includes articles by patients describing their own experiences. The magazine not only explains certain factors in diabetes, but encourages the patient to adhere to his strict formula.

Still another function of the American Diabetes Association is its support of camps for diabetic children. Most of these camps are operated by local affiliates and are held each summer throughout the United States. The camps show the diabetic child how to take care of himself properly in an atmosphere of outdoor life and fun.

The United States Public Health Service

While the American Diabetes Association gives assistance to physicians caring for diabetics and to diabetics themselves, the United States Public Health Service is concerned, for the most part, with research that may answer some of the questions about diabetes, development of techniques and materials for professional and patient education, and consultation to State and local health departments.

E. PROGRESS AGAINST DIABETES

The United States Public Health Service has two units primarily concerned with diabetes. Through research grants and intramural research, the National Institute of Arthritis and Metabolic Diseases has contributed to significant recent advances in the study of diabetes, including an increased knowledge of the relationship of the endocrine organs to carbohydrate metabolism, a method for the testing of the amount of insulin in the blood, the development of a strain of hereditarily overweight mice (valuable in research on the inheritance of diabetic tendencies), the development of modified forms of insulin, and the demonstration that the growth hormone secreted by the pituitary gland is related to the development of diabetes. Investigators are now concerned with the difficulty of controlling diabetes with insulin in some patients, the influence of diet on diabetic acidosis, the measurement of small amounts of insulin in blood, the relationship between the central nervous system and the control of the level of blood sugar, and the metabolism of sugar in the body in both health and disease.

One of the outstanding accomplishments has been the devising of a highly sensitive method for the assay of insulin in blood.

The Division of Chronic Disease and Tuberculosis is concerned for the most part with studies relating to the occurrence and distribution of diabetes, the number of cases of the disease, and the number of deaths from the disease; investigations of methods and techniques of detection, diagnosis and patient education; the provision of training courses for professional public health personnel, and the provision of professional consultation to State and local health departments in public health aspects of diabetes.

The Public Health Service diabetes epidemiological study was started in Oxford, Mass., in 1945. This continuing investigation is intended to gather information concerning the extent of the disease, and to study factors associated with identification of the prediabetic state. This study has provided the basis for our estimate of the amount of diabetes in the United States.

Research in methods and techniques of diabetes detection has resulted in the development of rapid, economical blood glucose tests which make possible the examination of large numbers of people in a relatively short time. With modification, the tests are also practical for use in the physician's office. The Hewson Clinitron (developed under Service auspices, to make possible the automatic testing of large numbers of blood specimens) makes feasible blood examinations in community-wide diabetes case-finding programs.

Studies of techniques of preserving blood samples have also been done by the Service. The use of blood preservatives allows shipment and storage of blood without deterioration, which permits the examination at a central laboratory of blood specimens collected in case-finding surveys.

Continuing studies are being done in the evaluation of the relative efficiency of urine, blood glucose, and glucose tolerance tests.

Since the patient plays an important role in the treatment of diabetes, it is essential that he be familiar with his disease. It has been estimated that he needs at least 10 hours of instruction in order to care for himself properly. He must be trained to recognize symptoms of diabetic acidosis (which can lead to coma) and insulin shock, know

how to administer insulin to himself, be able to follow his diet, and give his feet proper care.

In order to meet the educational needs of the patient, the kit, Taking Care of Diabetes, was cooperatively produced by the American Diabetes Association, the American Dietitic Association, and the Service. The kit contains film strips, recordings, posters, and booklets for the use of physicians and other professional personnel in individual and group education of diabetic patients. Six food exchange lists developed by the same group are used in teaching the patient how to plan his meals in such a way as to achieve variety in his diet. The six lists free the patient from the task of food weighing, and give him some dietary freedom with safety.

F. FUTURE PROGRESS

Diabetes may be accelerated by events or forecast by things of which we yet know little. These must be found. For example, it has recently been shown that in some women pregnancy creates such a stress that tests used during pregnancy may warn of the later development of diabetes in the mother and future trouble for the child.

The direct and predisposing causes of diabetes and its complications are not known.

The relationship between good control of diabetes and the prevention of its complications must be more certainly fixed. We must determine what constitutes control good enough to prevent complications Many of those complications seem to be disorders of fat metabolism, and low-fat diets may offer a means of preventing them.

The varying degrees of response to treatment among diabetics have, in addition to other factors, led to the strong suspicion that there may be more than one cause of the disease. Proper interpretation of those factors increases the probability of our finding more precise methods of prevention, diagnosis, and management.

Many mild diabetics are missed by ordinary detection methods, and intensive studies of the various methods of finding the disease must be made. Current detection and diagnostic methods are imperfect in a large number of borderline cases. The types of tests to be used, the best time for performing those tests, the levels considered to be positive, should be further evaluated in terms of cases missed and in terms of nondiabetics considered positive in detection programs.

We must investigate the many psychological factors that may keep the diabetic patient from accepting the implications of the disease. Knowledge of those factors is essential in educating the patient in the management of diabetes.

And we must study patients under various kinds of treatment, so we can find the best methods of treatment.

In spite of the fact that the cause of diabetes is not completely known, and in spite of our lack of answers in a number of areas, we have sufficient knowledge to gain effective control of diabetes if it is found in time. The most important measure known today in preventing the crippling complications and the premature deaths caused by diabetes is early detection. The earlier we find the diabetic patient, the better are our chances of controlling his condition.

The person who knows that he has diabetes, who understands the disease, and who works with his doctor on a systematic plan of diet, exercise, and insulin will be able to control his diabetes and live a happy and full life.

CHAPTER X

TUBERCULOSIS

A. SUMMARY

Testimony before the committee disclosed that, despite our tremendous advances against tuberculosis, this communicable disease continues to menace the public health of the Nation.

A summary of the information presented before the committee follows. It reveals that tuberculosis is still among the 10 leading causes of death in the United States; that its living victims number 1,200,000; and that, in terms of human misery and economic loss, its burden on the individual and his family, on the community and the Nation, is devastating.

It depicts the nature and scope of the public and private endeavors in the field of tuberculosis control and demonstrates that the partial success we have achieved is but the result of the mobilization of the resources of National, State, and local health departments, tuberculosis associations, professional societies, and hospital groups, working individually and cooperatively.

It delineates some of the scientific discoveries responsible for our accomplishments in the field of tuberculosis control, especially those recent ones that resulted in improvements in diagnosis and treatment of the disease.

It spotlights the many problems and stumbling blocks that lie between us and our goal of total eradication of tuberculosis, and establishes guideposts for future programs. It emphasizes the necessity of continuing research into the unknowns of tuberculosis and of devising methods of applying the vast amount of information we already have accumulated. It stresses the fact that this will require more trained workers, more facilities, and more money than are now available.

It warns that if we are to achieve control at all we must continue our efforts to find all the cases of tuberculosis, to treat them promptly, and to return them to normal living, well and capable of remaining well.

B. WHAT IS TUBERCULOSIS?

Tuberculosis, one of man's oldest and deadliest foes, is a communicable disease, spread by a germ—the tubercle bacillus. It usually attacks the lungs (pulmonary tuberculosis); but actually it can strike the skin, the bones, or any organ of the body; or it can even be generalized (miliary tuberculosis).

Today, generally each new case of tuberculosis in the United States comes from an old one. The principal source of the disease is the cough of the person who has tuberculosis; the germs, spread through the air by a cough, are inhaled by the well person. Another, but con-

siderably less significant, source is milk from cows infected with tuberculosis. Concerted efforts to eliminate this source of infection have been most successful.

Many of us have been exposed to the tubercle bacillus at some time in our lives, but we have been able to resist its invasion of our bodies. However, individual resistance varies and conditions such as fatigue, malnutrition, and prolonged emotional and physical strain may lessen the body's defense efforts. The factors, too, of age, race, sex, and geographic area play an important role in the amount of tuberculosis in our population.

Tuberculosis is an insidious disease that seldom gives any warning in its early stage. Sometimes signs like fatigue, loss of energy, indigestion, persistent cough, are overlooked or ascribed to some other condition. When more noticeable symptoms such as exhaustion, fever, and perspiration, loss of weight, severe coughing and sputum, do appear, then the disease has already progressed beyond the early or minimal stages. Discovered in the early stages, the disease is rather readily controllable; but when discovered in the late stages, tuberculosis has already had a high degree of fatality. Periodic X-ray examination of the chest is one of the simplest means of discovering tuberculosis early.

Tuberculosis is a chronic disease, one which may last for many years. Response to treatment is often slow and unpredictable, and there are numerous episodes during which the patient seems suddenly to get better or worse for no apparent reason. Frequently, there are relapses which result in permanent disability. Over a period of years, tuberculosis was treated traditionally by rest, good food, and good hygiene. Later, surgical and medical measures were introduced to rest the lungs. Within the past decade three important drugs have been used—streptomycin, para-aminosalicylic acid (familiarily known as PAS) and isoniazid. Recently, there has been great improvement in surgical measures for cutting out the diseased portions of the lung. Today, the prospects of recovering from tuberculosis are better than ever before, and are specially bright when the disease is found early.

Although there is as yet no vaccine as effective against tuberculosis as Jenner's is against smallpox, nevertheless tuberculosis can be prevented by the adoption of simple public-health measures. Through early discovery of every case of tuberculosis and proper medical supervision of the infected individuals, the chain of infection can be broken and the spread of tuberculosis can be halted.

C. THE HUMAN AND ECONOMIC BURDEN

Tuberculosis is a very costly disease—to the patient and his family, to the community, and to the Nation. In terms of lives lost, of the disaster and dislocation which it imposes on its victims, and of the burden which it thrusts upon society generally, tuberculosis has been and still is one of the costliest diseases of mankind.

No estimate can be made of the total toll of lives which tuberculosis has taken. Since 1900, while organized efforts have been attempting to stem the tide of tuberculosis, more than 5 million Americans died as a result of the disease. Yet, despite the stubbornness of the disease, organized control efforts have been richly rewarded by steadily de-

creasing tuberculosis death rates and steadily diminishing numbers of deaths. Between 1940 and 1952, deaths from tuberculosis in this country fell 59 percent, from approximately 60,500 to 25,000; and the death rate reached an all-time low of about 16 per 100,000 population for 1952.

Although we are succeeding in saving the lives of tuberculosis patients (a record which we have achieved through the rapid application of new knowledge regarding diagnosis and treatment), our progress has not been so rapid in preventing the occurrence of the disease. The number of cases of tuberculosis in this country, although it appears to have fallen slightly during recent years, continues at a high level. In all, about 1,200,000 Americans—eight out of every thousand of us—have the disease in some form, and less than half are known to the health departments. Of the 400,000 cases of active tuberculosis (i. e., persons in whom the disease is not arrested), about 250,000 are known, but the 150,000 others are as yet unidentified. Without proper medical and public health supervision, these 400,000 individuals with active tuberculosis are actual or potential spreaders of the disease. Furthermore, the 800,000 inactive cases of tuberculosis may become active again at any time, and thus they, too, are capable of spreading the infection unless discovered and placed under supervision.

In recent years the total number of new cases of tuberculosis reported to health departments has not changed much from year to year. According to health department records of newly reported cases, about 110,000 cases continue to develop each year. Since we know that many cases go unrecognized and unreported (frequently until death), this must be considered a minimum estimate of new cases of tuberculosis in our population.

Despite the lack of a proved, thoroughly effective vaccine that would confer immunity against tuberculosis, the disease can be prevented through identification, isolation, and treatment of persons with active disease. In a disease which is preventable, the toll of 25,000 deaths (1,200 of them among children under 15 years of age), of 110,000 new cases each year, and of a total of 1,200,000 cases, is both enormous and unnecessary. This is given further emphasis by the fact that tuberculosis is still among the 10 leading causes of death in the United States.

It is difficult to give precisely the total annual dollar cost of tuberculosis. Its implications are manifold and its burden is dispersed throughout the community. The cost of dealing with tuberculosis—for the individual family within which it strikes, and for the community which must cope with its damaging effects—is staggering. Income lost to persons ill with tuberculosis totaled about $500 million in 1952. In that year, about 250,000 Americans of working age were unable to work because of active tuberculosis—more than the entire labor force of the crude-oil and natural-gas industries in the United States. Moreover, from premature deaths due to tuberculosis in 1952, the loss to the Nation is estimated at about $1,500 million worth of future production.

These, however, are the indirect costs of tuberculosis. The more direct costs—those which are cash outlays by agencies in every community of our Nation and by the Federal Government—are estimated at a minimum of $620 million for 1952. Of this total, the Federal Government spent more than $300 million. More than half of the $620 million went toward hospitalization of tuberculosis patients.

Any estimate of the financial burden which tuberculosis imposes on the family would be unrealistic and misleading, since very few families can bear the cost of the disease by themselves and since most of the direct costs are actually borne by the community. However, by taking into account the total tuberculosis expenditures in the United States, the value of production lost each year, the annual loss of future potential earnings, and the number of new active cases in the United States, we can estimate roughly that each new case of tuberculosis costs the Nation some $30,000 in both direct and indirect costs.

Such indexes can never reflect the serious distress and dislocation which are suddenly imposed on a family when tuberculosis strikes one of its members—particularly if the victim is the breadwinner or the mother of dependent children. The long-continued period of medical care almost invariably involved in tuberculosis consumes the accumulated savings of most patients and their families. And in addition to financial problems, these families carry a heavy burden in terms of their psychological need for the ill person who is away from home. Financial readjustments, lowered standards of living, assumption of the wage earner's role by somebody else, interrupted schooling and uprooting of children, are anxieties frequently added to the afflicted families.

The newer methods of treatment are daily yielding sizable life-saving dividends. Hence, it is possible to forecast a decrease in the number of deaths from tuberculosis. And we can expect a decline in the number of new cases—but that decline will be less immediate and less rapid. Thus the dollar cost of tuberculosis will continue high for some time to come.

D. THE NATIONAL ATTACK ON TUBERCULOSIS

The national tuberculosis campaign is a summation of the efforts of National, State, and local health departments, tuberculosis associations, professional societies, and hospital groups—each performing its special functions and joining its efforts to those of the other agencies to produce the most effective tuberculosis program possible.

Because tuberculosis is a communicable disease and because of the magnitude of the problem it presents, the control of tuberculosis has become largely the responsibility of official health agencies.

Identifying the tuberculosis victims and treating them has entailed the expenditure of tremendous amounts of money by tax-supported agencies. The voluntary tuberculosis associations have contributed through educational programs to bring about an understanding of the disease on the part of the public and to obtain adequate support for programs of health departments and tuberculosis hospitals.

Role of State and local governments

At the turn of the century (when tuberculosis was second only to pneumonia as a cause of death) some 20 States were without any tuberculosis control activity. A milestone in the fight against tuberculosis was the establishment of the National Tuberculosis Association in 1904, branches of which subsequently have been established in nearly every State. Gradually State governmental agencies began to assume responsibility for the prevention and control of tuberculosis, so that by 1950 all States have some tuberculosis service. In 1952 the

State and local governments spent more than $250 million on tuberculosis control activities. About $200 million of this was used for hospital care alone.

State agencies promulgate and enforce State laws, rules, and regulations for reporting and isolating cases of tuberculosis. They may provide subsidies to other agencies in the form of grants, personnel, equipment, or supplies. They may offer supervisory and consultative services or may promote local programs of control. They may operate sanatoriums, clinics, laboratories, mass case-finding surveys, or other features of tuberculosis-control programs.

Authority in tuberculosis control is usually divided between 2 State agencies and sometimes among as many as 5 or 6. It is not uncommon for hospitalization of tuberculosis patients to be considered as completely separate from case finding. This situation stems from the evolution of the program which began as a sanatorium movement under individual boards and commissions, while mass case-finding measures developed later under the auspices of public-health agencies.

Passage of the Public Health Service Act of 1944 gave health departments a more prominent role among the State agencies. Certain regulatory functions are usually delegated to the State health department as is the reporting of tuberculosis cases. In most States, health departments either promulgate the laws or advise the legislature regarding them, and develop regulations concerning quarantine, hospitalization, and employment limitations of persons with tuberculosis. In a few States, in addition to the State health department, the State university or other agencies operate State tuberculosis hospitals and are responsible for determining and applying admission policies for hospitalization at State expense. Moreover, the States' promotional, supervisory, and advisory activities are usually considered functions of the State health department.

Financial assistance from the State includes purchase of care in local governmental hospitals or lump-sum payments and loan of personnel, equipment, or supplies. Financial support is given for tuberculosis clinics, nursing or hospital care, case finding, rehabilitation and other types of service. Usually, certain requirements are specified for the cooperating institutions obtaining the subsidy, ranging from close scrutiny of all administrative policies and practices to inspection of physical plant.

When tuberculosis cases are diagnosed, whether by private physician, sanatorium, hospital, clinic, or other agency, they are reported to the health department. The State health department maintains records of reported cases, makes statistical tabulations of these cases, and acts as a referral center to the local health units concerned with the supervision of individual cases. The United States Public Health Service works toward the standardization of reporting and tabulates data on tuberculosis cases reported. It also tabulates in considerable detail tuberculosis deaths by residence to expedite various epidemiological studies.

All but one of the States operate laboratories, and some of the State universities and large tuberculosis hospitals also maintain laboratories which provide services to private physicians, hospitals, clinics, and tuberculosis associations. Not all these laboratories are capable of performing all the procedures demanded by modern treatment methods and diagnosis—looking for the presence of tubercle bacilli in

sputum, examining gastric washings, inoculating animals, and testing the sensitivity of the tubercle bacilli to the drugs used in treatment.

Diagnostic and treatment clinics are provided by State agencies. Frequently they are connected with the outpatient departments of sanatoriums and medical schools. In many areas, State health departments operate stationary or mobile clinics which offer medical examinations, consultation, treatment, and laboratory services.

An outstanding recent development in the finding of tuberculosis cases has been the use of X-ray on a mass basis. This X-raying activity is directed toward the general public or toward special segments of the public, for example, admissions to and employees of hospitals and institutions, student groups, teachers, contacts of known cases of tuberculosis and persons suspected of having tuberculosis. In 1950, it was estimated that about 8.6 percent of our population was being X-rayed annually.

Another recent development in public-health practice has been the grouping of various tests to screen or detect hidden illnesses. X-rays taken for the detection of tuberculosis can also be read for signs of tumors and heart conditions. On the visit for the X-ray, additional tests may be made—blood samples are sometimes taken for tests for syphilis, diabetes, anemia, or other diseases; blood pressure, height and weight, and electrocardiographic readings may be taken, and sight and hearing may be tested.

Most States maintain their own tuberculosis hospitals through their health departments, boards of control, or similar agencies. In addition, State universities, tuberculosis boards, or commissions, departments of welfare and independent hospital boards operate hospitals which care for tuberculosis patients.

Provision of nursing services is another important feature of State tuberculosis-control programs. In addition to their supervisory, advisory and consultative functions, State health-department nurses provide some direct care to tuberculosis patients in many of the States. They sometimes accompany local public-health nurses on home-teaching visits, participate in educational workshops, and prepare educational materials. They may also act in a liaison capacity with sanatoriums, tuberculosis associations, and other agencies.

Medical social workers serve the needs of tuberculosis patients in a number of States. They work in tuberculosis hospitals in State welfare or university clinics, provide consultation to local clinics and sanatoriums, and maintain relationships for social-service functions with other State, local, and voluntary organizations.

Stimulated by the Vocational Rehabilitation Act of 1943, rehabilitation is also found among the services provided by the States. The vocational education agency, sanatoriums, and voluntary tuberculosis associations cooperate in providing counseling, recreation, and occupational therapy.

Close cooperation is usually maintained between governmental agencies and the tuberculosis associations. This may include joint planning, consultation and exchange of funds, equipment, or personnel.

The Federal Government and the National Tuberculosis Association are engaged in cooperative studies in the several States. Prominent among these studies are analysis of results of surgical procedures for resting the lung, clinical trial of new drugs, investigation of BCG

(a vaccine named for Calmette and Guerin) as an immunizing agent, inquiry into the problem of tuberculosis among the Indians, and development of better X-ray techniques in State and private institutions.

Role of the Federal Government

Among the several Federal agencies working in the field of tuberculosis control, the Public Health Service of the Department of Health, Education, and Welfare administers programs of technical assistance and applied research. The Service's Division of Chronic Disease and Tuberculosis administers a grants-in-aid program. During fiscal year 1954, $4,275,000 has been allocated to the States for tuberculosis-control activities. This money is used in the States to operate X-ray programs and diagnostic and treatment clinics; to furnish public-health nursing services to patients with tuberculosis and to their contacts; to provide medical-social work for tuberculosis patients in clinics and hospitals; to provide laboratory services to physicians, hospitals, and clinics; to conduct the case supervision necessary for a disease which is both chronic and contagious; and to carry on statistical and case-reporting activities. The principal determining factor in the distribution of these grants is the extent of the tuberculosis problem in the State, but consideration also is given to program plans to meet the problem.

Professional and technical services are provided by the Public Health Service to the States and, through the States, to local governments on all aspects of tuberculosis control. These activities include demonstrations in new or improved methods of finding tuberculosis patients and keeping them under proper public-health supervision, and of operating clinics and training professional personnel. Formerly, the Public Health Service gave direct assistance to large metropolitan areas in the conduct of communitywide chest X-ray surveys. In that cooperative program, the Service took X-rays of nearly 8 million persons in 25 of our largest communities, uncovering 50,000 cases of previously unknown tuberculosis.

In addition to aid in providing these services, applied research is done on a cooperative basis with non-Federal research organizations and institutions and investigators. The work is directed toward problems of prevention (chiefly through a study of BCG vaccination); of early diagnosis; of the manner and extent of the spread of tuberculosis; of the course of the disease; and of treatment techniques, particularly in the field of the newer antituberculosis drugs. The cooperative approach in studies of this sort promotes maximum economy of operation and greatest possible productivity.

BCG vaccination is being widely used abroad in an effort to prevent tuberculosis. Amid claims and counterclaims, there is little solid evidence of its value and there are wide differences of opinion concerning this vaccine and its use. A number of groups, including the Public Health Service, are trying to determine the precise value of BCG as an immunizing agent.

The Service has been engaged since 1946 in an investigation of BCG and other promising vaccines. The Service's long-range evaluation of BCG vaccination began with a cooperative study among the American Indians and has been extended to include the populations of several communities, the inmates of several mental and penal institutions, and the students of medical and nursing schools.

Thus far, the following conclusions have been drawn from the results of these wide-scale BCG studies. First, a very large proportion of the tuberculosis that appears in a population during the first few years after a vaccination program, evidently occurs in the group who would not have been vaccinated because they had already been infected. This implies that mass vaccination, even if BCG is effective, cannot be expected to have a large and immediate influence on tuberculosis mortality and morbidity rates. The second major point indicates why there is still uncertainty about the utility and effectiveness of BCG: so little tuberculosis appears among these eligible for vaccination, whether or not they are vaccinated. These studies do not indicate that tuberculosis in this country would be more effectively controlled by adding mass vaccination programs. Hence, the Public Health Service continues to recommend the use of BCG only for selected groups with known high risk of exposure to tuberculosis infection.

Research grants, including those for tuberculosis, are made by the Public Health Service through the National Institutes of Health. Over the past 3 years about $350,000 has been required each year to support research projects. Furthermore, from 1947 through 1951, the National Institutes of Health furnished some $200,000 worth of streptomycin and PAS to therapy evaluation studies in tuberculosis. Presently, antibiotics are furnished by the Division of Chronic Disease and Tuberculosis to coordinated clinical studies in which this Division has participated.

In the research grants program 29 separate investigators, in almost as many separate places, are performing different types of research into various aspects of the tuberculosis problem. The sites of the experimentation are mostly in universities, but they also include hospitals, medical research centers and, in one instance, a whole community. The subjects of the research are very diverse. They include investigation into the chemistry and structure of the tubercle bacillus, the sites where tuberculosis develops, the influence of diet on tuberculosis, the influence of heredity and environment in changing the tubercle bacillus' reaction to drugs, and a search for more effective antituberculosis agents.

The Microbiological Institute of the National Institutes of Health is investigating various tuberculosis vaccines, is studying some of the factors which might determine why tuberculosis develops more commonly in certain areas of the lungs, and is performing field studies of the extent and spread of tuberculosis.

The Public Health Service is engaged in other activities which also aid the tuberculosis control program. Through the mechanism provided in the Hospital Survey and Construction (Hill-Burton) Act, the Service, in conjunction with the State hospital planning commissions, provides part of the cost of expanding local hospital facilities, including additions, improvements and new construction for the care of persons with tuberculosis. (More than $5 million of Federal money was so spent in fiscal year 1952.) Through the Service's Division of Foreign Quarantine, aliens with tuberculosis (among other diseases and mental conditions) are excluded from entering the country. Medical care, treatment, and rehabilitation of tuberculosis patients are provided in Public Health Service Hospitals to Service beneficiaries.

Assistance to tuberculosis control programs is given by other Federal agencies. The Office of Vocational Rehabilitation of the Department of Health, Education, and Welfare operates a program of technical and financial assistance to States for the restoration of handicapped persons to gainful employment. The Bureau of Indian Affairs of the Department of the Interior cooperates with the State health departments in searching for tuberculosis among the Indian population on reservations and operates sanatoriums for the care of Indians with tuberculosis.

The Veterans' Administration plays an important role in the control of tuberculosis among veterans. All admissions to Veterans' Administration hospitals and clinics are routinely X-rayed, as well as the personnel caring for these patients These X-rays total 900,000 each year Analysis of this program shows a decreasing number of newly discovered cases among hospital personnel, a fact strongly suggesting that early discovery of tuberculosis in the patients has notably cut down on-the-job exposure of personnel The same decline is being experienced among veterans with service-connected ailments who, as outpatients of Veterans' Administration hospitals, are X-rayed when they appear for treatment, unless they have had an X-ray within the last 6 months. Within these two comparatively fixed groups of employees and outpatients, the incidence of tuberculosis is lower than within the population groups in which they live.

In addition to hospitalization of tuberculosis patients, the Veterans' Administration has engaged in a research program which has resulted in the development of treatment that has at least halved the death rate for tuberculosis in Veterans' Administration hospitals. The earliest studies of the effectiveness of streptomycin and PAS in tuberculosis were conducted in the Veterans' Administration hospitals.

For the 5 fiscal years preceding June 30, 1952, the Veterans' Administration spent a total of over $1,128,552,000 on tuberculosis. Thirty percent of that total—$339,980,000—represents the cost of hospitalization alone. Compensations and pensions amounted to $727,768,000 in that period. A comparatively small sum, $867,000 was spent on research that yielded rich rewards in improvement in treatment, and $410,000 was used for educating and training personnel in the field of tuberculosis. The total does not include the amount the Federal Government spent in insurance payments to dependents, nor does it include the amount spent on tuberculosis contracted by Veterans' Administration employees.

A small portion of the Federal funds is used for direct services in education of the general public. Federal participation in public education consists largely of consultation and assistance to national, State and local groups. Aid to professional education is provided by both the Federal Government and the National Tuberculosis Association. The National Tuberculosis Association has been active in the field of public education since 1904.

Role of National Tuberculosis Association

The National Tuberculosis Association, together with its State and local associations, is one of the oldest of the voluntary health agencies engaged in the control of tuberculosis. The association has hundreds of thousands of persons as members, board directors and staff. The medical section of the association, the American Trudeau Society,

has a membership of over 5,000 physicians. The association is supported, almost in its entirety, through the sale of the familiar Christmas seals bearing the double-barred cross.

From the beginning, the aim of the National Tuberculosis Association has been to interest as many persons as possible in tuberculosis through understanding their local needs and stimulating local action and programs. Education of the public has always been and still is the basic approach and goal of the voluntary health agency. For this reason, 94 percent of the money which is raised by the tuberculosis associations remains within the State and only 6 percent (at least one-sixth of which is earmarked for research) is sent to the national office which serves in an advisory and consultative capacity to State and local associations. The national office also assists its affiliated associations by producing health education materials for their use. It maintains close contact with official Federal agencies concerned with tuberculosis control.

The State and local associations follow the pattern set by the National Tuberculosis Association in working closely with health departments and other agencies in developing tuberculosis control programs. During the fiscal year ended March 31, 1952, all State and local associations spent $20,229,322. Of this total, $6,468,506 was spent on health education alone.

In addition to their role of educator, the tuberculosis associations contributed $4,057,613 to assist and promote health department programs to find unknown cases of tuberculosis. Because the cost of direct service or care of tuberculosis is prohibitive for any but tax-supported agencies, voluntary health agencies have attempted to use their funds to supplement official agency programs and to demonstrate to the public the need for additional programs and services. Comparison of the cost of finding a case ($700–$750 per active case found by survey of the general population) with the total cost of a case ($30,000) indicates why tuberculosis associations have chosen that aspect of tuberculosis control rather than any other for a major program expenditure.

The National Tuberculosis Association annually allocates tuberculosis research grants to medical schools and other research institutions throughout the country and provides fellowships for research scientists in these institutions. Among the particularly significant studies supported by the National Tuberculosis Association are: Life processes and hereditary factors of the tubercle bacillus and the manner in which it develops resistance to drugs used to counteract it; the nature of resistance which the body offers the tubercle bacillus and ways of increasing that resistance; the mechanism by which the tubercle bacillus destroys the tissues of the body; the function of the lung in health and disease; the drug treatment of tuberculosis in children; the manner in which tuberculosis spreads in population groups exposed to the disease; and factors influencing the diagnosis of infection.

E. PROGRESS AGAINST TUBERCULOSIS

Since 1882, when Robert Koch identified the tubercle bacillus as the germ causing the disease, we have accumulated a vast amount of knowledge about tuberculosis. The recent years have crowned the

work with several notable achievements. The treatment of tuberculosis has been greatly improved through the introduction of new drugs and the use of new principles in surgery. The recently developed drugs—streptomycin, isoniazid and PAS—have increased the promise of ultimate victory over tuberculosis. These drugs are effective in reducing the fatality rates, in making many more patients less infectious, in providing a more uniform and simpler treatment applicable to more patients. They both prepare the patient for new surgical procedures and assure the success of such operations. The development and improvement of surgical procedures for the removal, with relative safety, of tuberculous lung tissue, together with the new methods of drug therapy, give hope of shortening the usually prolonger period of treatment, and of arresting the progress of the disease in many cases which heretofore had been considered hopeless.

Diagnostic aids have also been improved. In this regard, the application of chest X-ray surveys as a method of finding tuberculosis in large, apparently healthy population groups has broadened the search for the hidden cases of tuberculosis which so often escape detection by routine methods. (These surveys were made possible through the earlier development of high-speed small-film X-ray equipment, which allows the economical X-raying of large numbers of people at great savings in time and personnel.) Other procedures for diagnosing tuberculosis have been made more accurate. The method of culturing and identifying the tubercle bacillus in sputum from the person suspected of having tuberculosis has been improved. Also, refinements have been made in the tuberculin test, i. e., the injection into the skin of a growth-product of the tubercle bacillus to establish, by the reaction, exposure to tuberculosis. In addition, knowledge regarding the X-ray appearance of changes in early tuberculosis and their significance in diagnosis is being broadened. All these developments enable us to find tuberculosis earlier and to diagnose it more accurately, to the advantage of both the patient and the community.

In the field of treatment itself, the coordinated clinical study has been devised and successfully tried. Through this approach, in which private investigators throughout the United States operate under a common protocol and pool their findings, we are arriving at earlier and more precise answers regarding the effectiveness of streptomycin, isoniazid and PAS.

In the current studies, 22 cooperating hospitals are furnishing the Public Health Service with full clinical information on the treatment of more than 1,500 patients in each of several studies. In addition, a number of independent investigators are also working on special aspects of the problem. The first study has demonstrated in little more than a year that isoniazid employed alone is as useful as streptomycin; and isoniazid used with streptomycin is slightly more effective than streptomycin and PAS (the best combination prior to the advent of isoniazid). Work in this vital field is going forward with continuing evaluations of various drug regimens involving streptomycin, PAS, and isoniazid. Special attention is also being given to the apparent success which can be obtained through the use of these drugs in military and meningeal tuberculosis—the two forms that most often strike, and with very high mortality, at children.

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F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

We have real hope for the eradication of tuberculosis through the intensification of current efforts and programs which aim to discover all persons with the disease, to isolate and treat all who have active or contagious tuberculosis, and to restore as many of them as possible to healthful and productive living. That community costs will continue at a high rate is anticipated in view of the following problems which are but a few of the many still confronting us. Until they are resolved, such problems will delay the elimination of tuberculosis as a national public health problem.

There is a shortage of hospital beds for tuberculosis patients. Fewer than 120,000 tuberculosis patients are in hospitals, and it is estimated that possibly 50,000 more beds are urgently needed. About 40,000 persons are now at home who have active tuberculosis with demonstrated tubercle bacilli in their sputa. Moreover, there are at least twice as many more at home who also have active tuberculosis, many of whom need either hospitalization or better care at home.

In many places, local health services are inadequate for the requirements of tuberculosis control, in terms of both facilities and personnel. Hence, case finding, diagnosis, case reporting and supervision are deficient in many ways. For example, only one-fourth of all the newly discovered cases are found in the early stages of the disease. Most cases are still being discovered in the advanced stages, when treatment is more difficult, more expensive, lengthier and when serious disability is more likely to result. Indeed one-fourth of all persons dying of tuberculosis are never reported as living cases of the disease. The health of the community cannot be protected while this amount of tuberculosis remains undetected. Moreover, these dangerously sick people receive no care or supervision for tuberculosis. Evidence of this is found in the fact that at least one-third of the known cases at home have not had X-rays or clinical examinations for 12 months or more.

Economic means tests and residence requirements are, in many places, serious barriers to hospital admission, threatening the public health through perpetuation of tuberculosis infection. The effects of residency regulations have been brought into sharp focus by the problems of vagrants, displaced persons, migratory laborers, and a generally mobile population. A solution must be found for the problem of tuberculosis among our rapidly shifting population.

Little assistance is given to most tuberculosis patients and their families in dealing with the social and emotional problems which the disease imposes on them. These problems often cause tuberculosis patients to refuse to accept medical advice regarding treatment and hospitalization or to leave the hospital against medical advice. Until help is given these patients in meeting these problems, they, too, threaten the public health.

Tuberculosis is especially prevalent in mental and penal institutions, where control efforts have been so meager. The disease not only flourishes within these institutions but spreads from them to surrounding communities. Some States have already initiated control programs within these institutions, X-raying their patients on admission and isolating and treating those inmates found to have tuberculosis.

Newer methods of treatment have presented problems regarding the most effective approach to the management of tuberculosis. The practicability and efficacy of treating patients who are not hospitalized must be determined.

Control in tuberculosis must continue to rest largely on early discovery of active cases, isolation and treatment of the infected persons, and maintenance of healthful living standards to keep resistance to this disease as high as possible. As long as there are unrecognized cases of tuberculosis among us, the official and voluntary agencies cannot relax their efforts. Even in those areas where tuberculosis seems to be controlled, we will need to maintain constant surveillance against possible resurgence of the disease.

Control of tuberculosis could be accomplished if we had a treatment capable of rapidly and completely curing tuberculosis in all stages; or if we had a vaccine that could confer complete immunity. Lacking these, we must continue to develop and apply fully the knowledge we already possess. Perfection of certain diagnostic techniques (like the tuberculin test) may well be in this category. To solve other less well understood problems will undoubtedly require an enormous amount of work. For example, our method of diagnosing activity of a tuberculosis infection is far from satisfactory. If a method for measuring activity could be developed, especially for application on a mass basis, then progress in tuberculosis work would spurt far ahead.

Although modern treatment methods offer much greater hope to tuberculosis victims than ever before, research must be continued on the known antituberculosis drugs, and new agents must be sought. All forms of collapse therapy must be carefully tested. Because of the shortage of hospital beds for tuberculosis patients, the need for improving the care of the unhospitalized patient becomes quite obvious. Rehabilitation of the tuberculosis patient is essential if he is to be restored as a useful citizen in the community. Much research is needed in the rehabilitation process of the tuberculosis patient, for little has been done in this field.

Because an effective immunizing agent could quickly reduce tuberculosis in this country to the proportions of smallpox as a public-health problem, the evaluation of BCG vaccine and the search for other immunizing vaccines will be carried on through thorough and extensive investigations.

Further investigation is needed of the tubercle bacillus itself—of its metabolism, genetics, chemical composition, and immunizing properties of its various chemicals. Better and more rapid culture methods of the tubercle bacillus need to be developed for assistance in diagnosis.

Susceptibility and resistance to the disease must be more precisely determined according to age, sex, race, degree of exposure, nutritional status, and environment. We have not yet ascertained whether physiologic differences or degree of exposure are responsible for differences in the amount of tuberculosis found in men and women. There is reason to believe that diet plays an important role in stimulating the body's resistance to the infection. Determination of that role would give us another weapon in the fight against tuberculosis. That hormonal factors may prevent tuberculosis from manifesting symptoms in children between the ages of 5 and 14 years, is suggested by the

increase in tuberculosis mortality in children after reaching puberty.

Continuing analysis of disease records can tell us who is getting tuberculosis and thus aid in determining to what extent racial, economic, or occupational factors are involved. We need to know which economic, social, and emotional factors prevent people with tuberculosis from accepting or completing treatment. Further study in this area is indicated if we are to make maximum use of available resources. In this age of rapidly shifting population groups, we need to know the extent and nature of the problems of tuberculosis among our migrating population and the influence of residence requirements on the entire tuberculosis control program.

Procedures and techniques used to protect personnel coming in contact with tuberculosis patients require careful testing. Basic research on description and classification of chest X-ray films is needed. Evaluation of the effectiveness of case finding methods is essential so that we can devise better means of reaching the reservoir of tuberculosis infection, for neither doctors nor drugs can help the undiscovered case of tuberculosis.

Improved and increased public understanding is needed so that people will take proper personal health action. This calls for the development of more effective methods for educating the public.

Though Koch identified the tubercle bacillus 70 years ago, and many workers have since contributed to our stockpile of knowledge about the disease, progress in tuberculosis can be achieved through discoveries about new things and new discoveries about old things, and through sound application of the knowledge that we already possess. This will require more funds and more trained workers than are now available in order to speed the development of scientific knowledge and techniques. These inadequacies of resources in the national tuberculosis campaign can be minimized through continued cooperation of all concerned—the voluntary associations, the State and local health departments, the professional and hospital groups, and the Federal Government. We do know that the cooperative endeavors of all these groups have brought us partial success; and we know what we must continue to do until we have finally achieved victory in the conquest of tuberculosis.

CHAPTER XI

POLIOMYELITIS

A. SUMMARY

The hearings before the Committee on Interstate and Foreign Commerce, House of Representatives, held on October 6 and 12, 1953, were devoted to a comprehensive discussion of poliomyelitis: its importance as a disease, its cost in both human and economic terms, its unresolved medical problems, and its promising research areas. Two aspects of poliomyelitis prevention and treatment were examined in the first day's testimony, and the second day dealt with the overall problem of poliomyelitis.

Although poliomyelitis has apparently afflicted man for many centuries, the cause of the paralysis, which is the important manifestation of this disease, was not appreciated until the late 19th century when it is was shown that the destruction of nerve cells which control the muscles is reponsible for the paralysis.

In this country research interests in poliomyelitis developed shortly after the turn of the century. The disease was first produced experimentally in monkeys and its causative agent identified as a virus in 1909. National reporting of the disease began in 1910, although all States did not participate until 1922.

Poliomyelitis research was initiated by the Public Health Service in 1910. The most extensive of its early field studies was an investigation in 1916 of the great outbreak concentrated in New York and New England. The central conclusion of this study was that poliomyelitis is spread by person-to-person contact infection. This conclusion still stands today.

During the early years, relatively little was accomplished in the laboratory largely because scientists lacked cheap, simple, effective methods of isolating, identifying, and maintaining poliomyelitis virus. The first step in overcoming this handicap was taken in 1939 when a Public Health Service scientist succeeded in growing a strain of poliomyelitis virus in cotton rats and mice.

A major impetus to poliomyelitis resarch was the establishment of the National Foundation for Infantile Paralysis in 1938. Since then, investigators supported by national foundation grants have developed a whole new body of knowledge in this field. One of their major achievements was the discovery that the disease is caused by three major and distinct types of poliomyelitis virus. Without this knowledge, progress in the development of an effective immunizing agent would have been impossible.

The 1940's also saw the development of important negative findings. By then, it was known that the virus of poliomyelitis could be readily found in sewage and flies during epidemics. This led the public to assume that poliomyelitis was spread by flies and could be prevented

by DDT fly-control programs. However, the results of extensive studies carried out by the Public Health Service indicated that such programs have no apparent influence on the development of poliomyelitis epidemics.

Under the auspices of the national foundation, large-scale field trials were carried out in 1951 and 1952 to determine the effects of gamma globulin in preventing poliomyelitis. In earlier years this fraction of human blood had proved its value against measles, infectious hepatitis, and German measles.

The results of the 1951 and 1952 field studies, in which about 28,000 doses of Red Cross gamma globulin were administered to children in Utah, Texas, Iowa, and Nebraska, indicated that from the second to the fifth week after inoculation gamma globulin provided about 75 percent protection from paralysis. On the basis of these results, the decision was made to administer gamma globulin on a nationwide basis to meet the minimal epidemic needs during the summer of 1953. All gamma globulin in the custody of the Red Cross at the beginning of 1953, and that obtained in the course of 1953, was turned over to the Office of Defense Mobilization for distribution to the States on a quota basis. The Public Health Service has undertaken an evaluation of the 1953 experience with gamma globulin.

Promising preliminary results were reported in 1953 in connection with an inactivated virus vaccine developed by a university investigator supported by the national foundation. A representative of the foundation emphasized in his testimony that the vaccine is still in the experimental stage and has yet to be proved effective. He further stated that even if the vaccine is shown to be capable of producing immunity to poliomyelitis, considerable amounts of money will continue to be spent in searching for a better vaccine.

In the field of patient care, medical acceptance of the Sister Kenny method of treatment and the formation of the Kenny Foundation in Minneapolis in 1943 represented major developments. The Kenny Foundation was organized to train nurses and physical therapists in the techniques of the Kenny treatment for minimizing the crippling effects of poliomyelitis. The foundation also conducts medical seminars for physicians and supports a limited program of clinical research.

Advances in the management of the paralyzed poliomyelitis patient and greater diffusion of knowledge of improved treatment methods in recent years have served to limit deformities, particularly in the severely paralyzed patient. These advances have emphasized the need for increasing the number of physical therapists and for expanding rehabilitation facilities.

Another pressing need—one which will confront the Nation for many years to come, even if poliomyelitis control is effected through immunization—is occupational rehabilitation. In 1951 about 3,800 people crippled and disabled by poliomyelitis were returned to work and normal living under the Federal-State program of occupational rehabilitation. During the same period about 6,000 persons were added to the national backlog of poliomyelitis victims in need of rehabilitation services.

With regard to future advances in the overall field of poliomyelitis, the opinion was expressed that research emphasis should be placed on supporting the work of competent investigators rather than on foster-

ing a rapid and unbalanced increase in research facilities. Despite rapid progress against poliomyelitis in recent years, many problems remain unsolved and the need for critical research will continue for many years to come. What has been accomplished in the past can best be extended and strengthened if the Nation continues to support through private contributions the work of the voluntary organizations such as National Foundation for Infantile Paralysis.

B. WHAT IS POLIOMYELITIS?

Poliomyelitis is an acute infectious disease which primarily attacks children and is caused by specific organisms too small to be seen under an ordinary microscope. These agents, or viruses, sometimes enter the central nervous system where they attack the gray matter of the spinal cord, ultimately causing a weakness or paralysis of certain muscles or muscle groups, which may lead to crippling or death. In most cases, however, the viruses multiply in the lower intestinal tract, producing a mild or inapparent infection with no signs of central nervous system disturbance.

Diagnosis of poliomyelitis, especially in the early stages, may be very difficult since there is no specific test to verify the presence of the disease. The first symptoms commonly include one or more of the following: fever, headache, malaise, nausea, and vomiting. Except in unusually severe cases, there is no stiffness of the neck and no muscular pain at this time. A positive diagnosis cannot be made, since all these symptoms are indistinguishable from those of a nonspecific respiratory infection. Most children with these symptoms recover completely, either because they have a common upper respiratory infection or a very mild case of poliomyelitis.

If, however, the fever begins to rise again after several symptom-free days, the so-called second stage of poliomyelitis may be developing. In this stage the fever is higher and more sustained, the malaise more apparent, headache and vomiting usually more pronounced. Definite symptoms of poliomyelitis may now appear. The patient complains of pain in the back and neck, and often in one or another of the extremities. Stiffness of the back is noted.

A spinal puncture may be taken at this point, and if an increased number of cells is found, with or without high protein values, the diagnosis of poliomyelitis is probable. Although an increased cell count in the spinal fluid is the best single sign of the disease, it cannot be relied upon absolutely but must be judged in conjunction with other signs and symptoms. In the 10 to 15 percent of cases in which the cell count is not increased, bulbar symptoms or definite paralysis and muscular weakness can decide the issue. (Bulbar poliomyelitis is that type of the disease affecting the base of the brain and accounting for a large percentage of the deaths in poliomyelitis.)

If, in spite of all efforts, the diagnosis is still in doubt, the patient's interests are best served by treating him as a suspected case of poliomyelitis until a more exact diagnosis can be made. In such doubtful cases, laboratory and X-ray examinations and careful clinical observations must continue until a definite diagnosis is made.

Once such diagnosis is made, treatment should begin without delay, preferably in a hospital, since even the mildest cases may suddenly

develop bulbar symptoms and require emergency care. Treatment will include supportive measures (fluids, food, oxygen, etc.).

C. THE HUMAN AND ECONOMIC BURDEN OF POLIOMYELITIS

Poliomyelitis, a relatively rare disease in the early years of this century, has since been recognized as a communicable disease problem in every State of the Nation. During the last 20 years, the trend of the annual case rate has been upward, especially in the last decade when a marked increase occurred. The death rate has shown a slight but definite increase. In 1952, for the Nation, both the case rate and the estimated death rate were the highest since the 1916 epidemic. Over the last 20 years, the ratio of reported deaths to reported cases has dropped.

In the 1932–52 period, the number of cases in the United States per 100,000 population varied from a low of 1.3 in 1938 to a high of 36.9 in 1952.

If the reported cases of poliomyelitis in the United States for each month are averaged for a few years, the resulting curve rises slightly in May, more rapidly in June and July, and reaches a peak in August and September. In October there is a marked decline which continues through succeeding months.

In the earlier years of the century, observers noticed that case rates were higher in the northern than in the southern regions of the country. In recent years this difference has diminished and an east-west differential is more prominent. During this period both average and maximum rates have been higher in the western and north central divisions of the United States than in the northeastern and southeastern divisions. Over extended periods of time geographic concentration has not been consistent.

In southern regions of the country, seasonal rise in incidence occurs earlier and the epidemic span is longer than in the northern regions.

The principal problem in poliomyelitis is crippling. Since the disease mainly strikes the young—small children and adolescents—a large number of its victims must be cared for many years and many carry a burdensome handicap throughout their lives.

Of the victims of poliomyelitis, 50 percent recover completely; 30 percent have no disabling aftereffects, 14 percent are severely paralyzed, and 6 percent may die.

Recently, the National Foundation for Infantile Paralysis attempted to calculate the risk of contracting a diagnosable case of poliomyelitis. In 4 representative States, it appeared that among children born in 1930, 1931, 1932, 1 out of every 156 acquired poliomyelitis during the first 20 years of life. In those same groups of children, 1 out of every 1,945 died of the disease before reaching the age of 20.

Compared to many other infectious diseases, however, the relatively low incidence of paralytic poliomyelitis is counterbalanced by the permanence of the resulting disability, since treatment—prolonged and expensive as it is—is only a palliative.

The extent of the economic burden of the disease on the Nation is illustrated by figures compiled by the National Foundation for Infantile Paralysis. From 1938 through 1952 the national foundation

spent $145 million for patient care. In 1952 alone the patient-care program expenditures totaled almost $25 million for aid to 80,000 poliomyelitis patients, more than half of them victims of previous years. As these figures indicate, a serious problem in the foundation's patient-care program is the cumulative caseload deriving from previous epidemic years.

The long-lasting effects of the disease are illustrated by a national foundation study covering a 4-month period in 1953. Of 6,064 poliomyelitis patients admitted for treatment in this period, 1,031 had their initial attack in 1948 or before; 388 in 1943 or before. During 1953 the national foundation was still paying for care of some victims stricken in the 1916 epidemic.

The average cost of inpatient hospital care of poliomyelitis patients in the first 7 months of 1953 was $14 per patient-day. The daily average cost of care of a patient in an iron lung is about $19. Service to respirator patients can cost as high as $10,000 to $12,000 a year for a seriously involved case. The National Foundation reported there are more than 1,500 patients today in iron lungs for all or part of each day.

The following figures illustrate equipment costs. An iron lung costs from $1,800 to $2,100; a rocking bed from $700 to $1,500. The price of a portable chest respirator and its accessories is about $1,250; hot-pack machines used in hospitals range from $225 to $400. A wheelchair costs around $175, and braces, for leg or back, from $50 to $300. National foundation chapters supply these items to patients and hospitals as required.

A striking illustration of the financial burdens this disease imposes is that of a physician in Santa Cruz, Calif. He received national foundation care at the rate of about $14,000 a year from late 1949 through 1951. In 1952 this was reduced to about $5,500 because the physician, though still forced to spend some time each day in an iron lung, had resumed the practice of medicine.

An analysis of patient-care bills received by the national foundation in the first 5 months of 1953 showed that the average cost for treatment per patient was $629, of which the national foundation contributed $550 for each. Cost of equipment used is not included. National foundation chapters carry individual patient-care expenses as long as the attending physician believes treatment will bring benefits to the patient and the family cannot pay full costs of essential followup treatment. Maximum recovery usually can be expected within 18 months, but many cases go far beyond this.

To determine what age groups bear the brunt of poliomyelitis, the national foundation made a study of 35,882 original acute admissions reported to the organization in the period July 20 to December 31, 1952. The study showed that 54 percent of the patients were under the age of 10; 24 percent were age 10 to 19; and 22 percent were 20 and over. Up to the age of 20 more boys than girls fall victim to the disease; above that age the proportion changes, and of all females in the group studied, 28 percent were in the age group 20 and over.

There is no way of estimating manpower loss accurately in terms of interruption of schooling and other factors. Permanent crippling of the boys and girls under 20 means perhaps 50 years of economic handicap. Recovery periods after a poliomyelitis attack often extend for months, and some patients cannot be restored to earning power

for years, if at all. Among women of 20 and over, the high incidence is especially serious, since the disease strikes into the group of young mothers whose loss to their families is incalculable.

A practical contribution to patient care in recent years has been support by the national foundation of seven regional respirator centers located in various parts of the country. Several hundred of the most seriously afflicted poliomyelitis patients—those with breathing difficulties—have been grouped for care and study and rehabilitation. In 1952, 5 centers discharged 303 of these patients—70 percent of whom were completely weaned from respirator devices. The sum of $800,000 had been authorized for the operation of these centers through 1952. It is the hope of the national foundation that through work done in these centers many iron-lung patients of the future will be able to live at home and lead useful lives.

The medical rehabilitation of the poliomyelitis patient has had far-reaching effects in the rehabilitation of many suffering from other chronic diseases and other forms of physical disability. This is illustrated by the training of physical therapists. At present there are about 6,000 physical therapists in the country. Two thousand of these have been trained by the National Foundation for Infantile Paralysis. A recent survey of the needs of this country in the total field of rehabilitation, over and beyond those for poliomyelitis alone, has shown that the Nation could use 2 or 3 times as many physical therapists today, and an increasing number in the future.

Physicians are also being trained in the field of rehabilitation. At present there are about 200 trained specialists certified by the American Medical Association's certifying board of specialists in the field of physical rehabilitation. Many more physician specialists are needed in this field.

There is a growing need for additional rehabilitation facilities, both in general hospitals and the so-called rehabilitation centers, where the severely disabled, including poliomyelitis patients, can be given comprehensive care. All these needs for trained personnel and specialized facilities can be expected to increase as medical science develops new techniques for saving lives and restoring the disabled to normal living.

In the field of occupational rehabilitation, as in the medical care area, one of the major problems in poliomyelitis is the cumulative backlog of people in need of rehabilitation services. The Office of Vocational Rehabilitation, which administers the Federal-State program of vocational assistance, reported that about 15 percent of the people who have incurred serious paralytic poliomyelitis and should have comprehensive rehabilitation service have not been getting it in the last 20 or 25 years.

Under the Federal-State program, 3,800 poliomyelitis victims were rehabilitated in 1951. Their average age was 22, and most of them were unemployed and supported by their families when they applied for rehabilitation. Their earnings totaled about $728,000 a year. After rehabilitation, when they had been in their first job for 3 to 6 months, their earnings came to $7,400,000, an increase of 900 percent.

The rehabilitation services provided to these people included five categories. Forty-nine percent of the group received training: 16 percent were given physical restoration; 9 percent received both train-

ing and physical restoration; 3 percent were given other services; and 23 percent received guidance, counseling and placement only.

D. THE NATIONAL ATTACK ON POLIOMYELITIS

From the early 1900's well into the 1930's there was considerable scientific interest in the nature of poliomyelitis. Studies by the Public Health Service, for example, were initiated as early as 1910. For the most part, however, the interest in this period was that of unsupported individuals who investigated, within their own limited means, those phases of the problem which particularly interested them. Scientific knowledge was sparse, and—in many phases—contradictory. At that time viral diseases were poorly understood and scientists lacked the basic techniques and tools for studying them.

With the establishment of the National Foundation for Infantile Paralysis in 1938, there began a scientific plan of attack against poliomyelitis designed to accumulate the basic knowledge that would ultimately lead toward control of the disease. This was made possible through the private contributions of the American people. As a result, the National Foundation has been able to supply the leadership needed to expand research in poliomyelitis, to initiate a program of professional education, and to furnish through its chapters medical care assistance to the victims of the disease.

Because poliomyelitis research in this country is adequately supported by the National Foundation, the Public Health Service, under its research grants program, does not support studies on poliomyelitis as such. It does, however, support a considerable volume of basic research in the broad field of viral diseases. Much of this work has implications of direct interest to investigators in the field of poliomyelitis.

In its own laboratories, the Public Health Service operates two relatively small poliomyelitis research programs, designed to supplement the more extensive programs of the National Foundation. Basic studies in virology are conducted by the National Microbiological Institute, which is also responsible for carrying out the provisions of the biologics control law. (Any immunizing agent against poliomyelitis must be tested and licensed by the Institute before it can be placed in general use.) At the Communicable Disease Center, the Public Health Service also conducts certain diagnostic and field studies on poliomyelitis.

In the period from 1938 through 1952, the National Foundation spent approximately $145,000,000 on patient care, about $18,100,000 on research, and some $16,400,000 on professional education in the form of fellowships, scholarships, and refresher courses to physicians and others.

For the year 1953, National Foundation research expenditures alone were expected to total about $4 million. This compares with about $300,000 allocated to poliomyelitis research in the fiscal year 1953 by the two divisions of the Public Health Service conducting programs in this field.

In addition to the work of the National Foundation for Infantile Paralysis and the Public Health Service, important activities have been carried on by the Sister Kenny Foundation since its formation in 1943. This work is financed by public subscription and is directed

mainly toward training nurses and physical therapists in the Kenny method of treatment in poliomyelitis. Under its scholarship program, the Kenny Foundation offers 2-year specialized courses in Kenny therapy. It also conducts medical seminars for physicians and supports a relatively small clinical research program.

E. PROGRESS AGAINST POLIOMYELITIS

Within the last 4 or 5 years, tremendous strides have been made in poliomyelitis research. A major contribution in this period was the development in 1949 of a method for growing poliomyelitis virus in test tubes containing bits of nonnervous tissue. Before this discovery by a Harvard grantee of the National Foundation, scientists had been able to grow poliomyelitis virus only in the bodies of certain experimental animals, mainly monkeys. Thus, the virus needed for producing possible vaccines could be obtained only from the infected brains and spinal cords of these animals. A vaccine prepared from virus grown in nervous tissue, however, is too dangerous for human use, since nervous tissue injected into man held within it the threat of an illness even worse than poliomyelitis. Until poliomyelitis virus could be produced free of nervous tissue, the outlook for a vaccine was not encouraging. That is why the development of tissue culture methods heralded the end of the monkey era in poliomyelitis research and the beginning of a new period in vaccine investigation.

Another stumbling block in the path of researchers was removed in 1951 with the completion of a National Foundation-supported project aimed at finding out how many types of poliomyelitis there are and how they differ. The results of the 3-year study, carried out by teams of scientists at four universities at a cost of $1,370,000, indicated there are three major types of poliomyelitis virus capable of causing the human disease. This knowledge made it clear that any preventive measure devised would have to be prepared in such a way as to make it effective against all three types of virus.

Whether a vaccine for poliomyelitis—assuming that one could be developed—would actually work was a question still unanswered. Investigators had long believed that the virus usually entered the body through the mouth and made its way from the intestinal tract by tiny nerve connections to the brain and spinal cord. There was little or no scientific evidence that the virus was ever in the blood stream at any time. Thus it appeared unlikely that a vaccine which induced the production of antibodies circulating in the blood could be effective if the virus was never present in the blood.

Early in 1952 came significant reports bearing on this question. Scientists at Yale and Johns Hopkins tested monkeys and chimpanzees experimentally infected with poliomyelitis virus. Within a few days after inoculation, the virus was found in specimens of blood taken from the animals. The scientists reported that the virus remained there for only a brief time before entering the brain and central nervous system and there did its real damage. However, the fact that at one stage of the disease the virus was in the blood stream meant that there was a time and place at which antibodies could be effective in protecting against paralytic attacks. The scientists also demonstrated that if small amounts of poliomyelitis antibodies were administered to the animals shortly before the time of exposure, both viremia (virus in the blood stream) and paralyis would be prevented.

During this period two important advances in poliomyelitis research were reported by the Public Health Service. In 1951 scientists at the National Microbiological Institute succeeded in transmitting the Leon type of poliomyelitis virus to mice for the first time. This was accomplished by the development of a very delicate and precise technique for injecting the virus directly into the spinal cord of mice rather than into the brain, which was the customary procedure. Up until now, only the Lansing type of poliomyelitis virus had been transmited to small laboratory animals—a notable advance made in 1939, also by a Public Health Service scientist.

In 1953, the last of the three known types of poliomyelitis virus—the Brunhilde type—was adapted to mice by scientists of the Public Health Service's Communicable Disease Center. Transmission of all three types of virus to small, inexpensive laboratory animals meant, among other things, that investigators now had a cheap and effective method of identifying previous infection in man without resorting to the use of monkeys.

A major step in the development of an immunizing agent for protection against paralytic poliomyelitis was taken in 1951 and 1952 with the inauguration of large-scale field tests of gamma globulin, the human blood fraction which had earlier demonstrated its value against such diseases as measles and infectious hepatitis. In these tests, supported by the National Foundation for Infantile Paralysis, 28,000 doses of gamma globulin (and an equal number of gelatin injections for control purposes) were given to children in 4 States.

The results indicated that gamma globulin had limited prophylactic value from the end of the first week through the fifth week after injection. Approximately 36 cases of poliomyelitis were prevented, or a little over 1.4 cases prevented, per thousand gamma globulin injections. (The other injected children would not have been expected, on a statistical basis, to develop poliomyelitis.) Computed on the basis of about $10 per dose of gamma globulin, this means an expenditure of $10,000 for the prevention of from 1 to 2 cases of paralytic poliomyelitis per thousand injections.

Following a study of all available data, the National Research Council recommended that every reasonable effort should be made to provide adequate amounts of gamma globulin for minimal needs for the 1953 poliomyelitis season. The Office of Defense Mobilization was given responsibility for coordinating the distribution of gamma globulin supplies made available for this purpose by the American Red Cross, the National Foundation for Infantile Paralysis, and any other source.

Under the plan adopted for allocating gamma globulin to State health officers, approximately 57 percent of the total supply available for poliomyelitis was to be distributed in a predetermined fashion based on the past and current experience of the States with poliomyelitis. Approximately 33 percent of the total would be retained in the common pool for mass community prophylaxis upon application of States having serious epidemic situations; and an additional 10 percent would be retained for unusual or special situations, for emergency distribution, and for special investigations.

An evaluation of the Nation's 1953 experience in combating poliomyelitis with gamma globulin has been undertaken by the Public

Health Service's Communicable Disease Center. Results of this study were expected to be ready for presentation in early 1954.

The year 1953 also witnessed important developments in connection with an inactivated virus vaccine against poliomyelitis. This experimental vaccine is the work of a University of Pittsburgh investigator, supported by a grant from the National Foundation for Infantile Paralysis. It is prepared from virus of all three types, grown in thousands of sealed test tubes nested in slotted drums that revolve slowly in warming ovens. When ready for harvesting, the virus is removed, suspended in a salt solution, and then exposed for a time to the chemical formalin, which makes it incapable of causing disease.

The vaccine was first administered to monkeys and chimpanzees, then to a small group of children and adults. The results indicated that the preparation caused no undesirable side effects and did produce a significant increase in the number of protective antibodies. The tests were then extended to include more than 700 children and adults, with continued excellent results.

On the basis of these findings, the National Foundation began to formulate definite plans for a scientifically controlled human study in 1954 to evaluate the effectiveness of the vaccine in protecting children against the naturally occurring disease. This would entail the vaccination of large numbers of children in many communities during a nonepidemic period and observing the degree and extent of protection afforded when poliomyelitis epidemics next visit their communities.

F. PROBLEMS AND NEEDS RELATED TO FUTURE PROGRESS

Perhaps the most compelling problem confronting the field of poliomyelitis today is the determination of the safety and effectiveness of the inactivated virus vaccine developed by a National Foundation grantee. Before this product is given a large scale trial under actual epidemic conditions, it is important that it pass rigorous safety tests, not only by the investigator who developed the vaccine but by outside laboratories as well. The results must be reproducible by all groups testing the product.

Many years of critical research will be necessary before all the crucial questions regarding poliomyelitis vaccines will be answered. No one can say at present that an inactivated virus vaccine will be the solution to the problem. It may be that future research will point the way to a vaccine prepared from attenuated live virus and affording greater and longer-lasting immunity than that produced by a "killed" virus vaccine.

In a real sense, research on immunization methods for poliomyelitis has scarcely begun. In this connection, it is worth noting, for example, that studies on smallpox vaccine are still being conducted today despite the fact that an immunizing agent against this disease was developed at the end of the 18th century. The same is true of diphtheria, a disease whose incidence has been drastically reduced in this century largely as the result of widespread immunization of children. With these, as with many other biological products, much work remains to be done to improve their value as public health measures.

Until a safe and effective poliomyelitis vaccine is ready for general use, the passive transfer of protective antibodies by means of gamma globulin appears to last only a few weeks, this weapon is viewed attack of paralytic poliomyelitis. Because the protection afforded by gama globulin appears to last only a few weeks, this weapon is viewed by many as an interim or stop-gap measure pending the results of the evaluation made of the 1953 experience with the gamma globulin program.

Another problem which will require continued research is the need for a simple, rapid diagnostic test for poliomyelitis. Such a test would be of inestimable help to physicians, who often are unable to diagnose the disease in its early stages on the basis of a clinical impression.

There is also great need in the control of poliomyelitis for a chemotherapeutic agent, a drug which will cure the infection promptly, alleviate its acute symptoms, and prevent the crippling or lethal paralysis which might otherwise ensue. Much work has been done in this area with no significant success thus far. Unlike the search for a successful vaccine, which takes direction from an orderly, planned progression of studies and experiments, efforts to find a specific treatment drug are more likely to stem from research entirely unrelated to poliomyelitis. This has been the situation with respect to many other diseases.

Another area in which more work is needed is the specific pathogenesis of paralytic poliomyelitis. It is now known that the virus circulates in the blood in the early stages of the disease. What are the factors within the individual or his environment which—once in a hundred or more cases—permit the virus to enter and damage the central nervous system, causing paralysis? Related to this consideration is the determination of whether or not this rare circumstance is controllable or preventable. If it is, then another means of protection against paralysis might become available.

There is need for general recognition that present research on poliomyelitis is only a prelude and that continued progress depends on extending and refining work thus far undertaken. To do this, competent and trained investigators must be encouraged to enter the field and given every opportunity to pursue their studies with a maximum amount of freedom. In the main, this can best be accomplished when support is flexible and work is not restricted to rigidly specified problems.

The supplying of research facilities is an adjunct to this problem and should not take precedence over the recruitment and training of personnel. There is a real danger in directing primary interest to the provision of physical facilities at the expense of finding and developing enough investigators who can profitably use these facilities in the advancement of knowledge.

In the field of medical rehabilitation, further progress depends in considerable measure on the recruitment of more nurses, physical therapists, and physicians. Lack of suitable training facilities is not the central problem. In the case of physical therapists, for example, a recent survey has shown that available schools are not filled. The

difficulty rests in the competition for professional workers in all areas, resulting in general personnel shortages.

The overall field of rehabilitation—after care and occupational assistance—will remain a challenging problem in poliomyelitis for years to come. Each year the backlog of persons crippled by the disease and needing assistance increases. Even if an effective preventive measure were developed tomorrow, it would take years to restore to normal community living all the victims of poliomyelitis from past years.

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